DEC 1 0 1924

Vol. 17 DECEMBER 1924 No. 6

JOURNAL OF ECONOMIC ENTOMOLOGY

Official Organ American Association of Economic Entomologists

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Published by
American Association of Economic Entomologists
Geneva, N. Y.

Entered March 14, 1921, as second-class matter at the Post-office at Geneva, N. Y., under the Act of Congress of March 3, 1879

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JOURNAL
OF
ECONOMIC ENTOMOLOGY
OFFICIAL ORGAN AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

VOL. 17 DECEMBER, 1924 No. 6

STUDIES OF THE PARASITES OF THE ALFALFA WEEVIL* IN EUROPE

By T. R. CHAMBERLIN, *Assistant Entomologist, Bureau of Entomology, U. S. Department of Agriculture*

ABSTRACT

The following is a brief account of a study of the parasites of the alfalfa weevil, *Phytonomus posticus* (Gyll.), made in Europe by the writer between August, 1921, and August, 1923. The 14 primary parasites encountered are listed and their habits and distribution briefly considered. As a result of this work the writer has come to believe that most of the more important parasites could withstand a climate similar to that of Utah, which is in the middle of the weevil-infested territory in the United States, that the apparent effect of the parasites upon the number of weevils in Europe is not a true measure of what their effect would be in this country, and that it is advisable to attempt the colonization of the more promising ones.

Early studies of the parasites of the alfalfa weevil were made in Europe by W. F. Fiske, H. S. Smith, and W. R. Thompson in the years of 1911, 1912, and 1913. This work was discontinued in 1913 and owing to the World War was not taken up again for some years. Later, as the weevil spread to new territory in the United States, interest in the parasites again arose. By 1921, one parasite which had been introduced in the early importations had spread from the original point of introduction near Salt Lake City, Utah, until it covered practically all the weevil-infested territory in the United States and probably had become a factor in reducing the injury of the weevil. Consequently, it was thought advisable to renew the study of other parasites in Europe before further importations were attempted. It was to make these studies that the writer went to Europe in 1921.

Briefly, the main problem was to find new parasites, to establish the primary or secondary character of those involved, to determine if possible the importance of the parasites and the part they play in weevil

**Phytonomous posticus* (Gyll.).

control in Europe, and to select the most promising species for colonization in the United States. The immediate task was to locate the chief alfalfa tracts in France and Italy and those which could be profitably investigated from the Hyères, France, laboratory of the U. S. Bureau of Entomology. After locating these tracts, it was necessary to scout them sufficiently to determine those in which the weevil could be collected to advantage and later to select the tracts or individual fields in which parasites could be collected in numbers sufficient for study or exportation.

A survey of the southeast quarter of France, made in September, 1921, indicated that alfalfa is grown to a greater or less extent throughout most of this region. It is found along the Mediterranean coast from Marseilles to the Italian border, and along the Rhône Valley north to Lyons. Little or no alfalfa is grown for some distance northeast of Lyons in the vicinity of the city of Bourg, but farther north near Lons-le-Saunier it is cultivated and from here some distance back into the hills almost up to Champagnole. Some alfalfa is grown between Poligny and Dijon, notably in the vicinity of the villages Mont-sur-Vaudrey and Villette-lès-Dôle. It is found also extending up most of the mountain valleys east of the Rhône, and is rather common near Annecy, Chambéry, Gap, and Digne.

In our experience, weevils were most plentiful in the Rhône Valley between Valence and St. Rambert, near Lons-le-Saunier, Chambéry, Annecy, and Gap. There were several fields in or near Hyères which contained a fair number of weevils. These were watched rather closely throughout the year. The regions in which the most parasites were found were the Rhône Valley in the section just mentioned, and the Lons-le-Saunier and Chambéry sections. Many parasites were found in the Hyères section, but this probably was due to the fact that more time was spent there than elsewhere in searching for them, and because in some cases favorable conditions were provided for their accumulation.

Alfalfa tracts in Italy were fairly well known from the work of Fiske, Smith and Thompson. At that time parasites were more easily obtainable in the vicinity of Naples, Milazzo, and in the Ternese Valley, and in view of this fact no extended explorations were made elsewhere in that country. In 1922 and 1923 most of the parasitized material came from Montecorvino, south of the Bay of Naples, and from Piedimonte d'Alife, a town about 40 kilometers north of Naples in a region said by Dr Silvestri to be much given to the cultivation of alfalfa.

Although the methods of collecting parasites were fairly simple, the parasites were so scarce that much territory and material had to be examined before they were obtained in any numbers.

Larval parasites were much easier to find than the egg parasites or the pupal parasites. The former were obtained by sweeping the weevil larvae from the fields and rearing or dissecting the parasites from them. The egg parasites were found by first dissecting the parasitic larvae from collected stems and afterward rearing them to maturity in wooden cells under direct observation in the laboratory. Only a small percentage of the early dissections showed weevil eggs, and only a small portion of the egg masses found contained parasites. In studying parasites of the prepupa and pupae, it was necessary to collect large numbers of cocoons of the host. This was done chiefly by picking up the cocoons from the stubble in newly cut fields. This work was slow and tedious at best, and owing to the fact that many hosts were removed from the field by cultural practices, parasites, and disease, before the cocoons were spun, cocoons were harder to find than any other stage, and in our experience they could be collected profitably from very few fields. The study of cocoon parasitism was especially difficult owing to the great number of primary and secondary parasites in various stages that might be found in them.

The chief parasites and some of their habits are described briefly below:

Parasites of the Eggs

Peridesmia phytonomi Gahan[1]

The larva of this pteromalid parasite feeds externally upon the eggs of *Phytonomus posticus* (Gyll.) and *Hypera punctata* (Fab.). It appears to be widely distributed in Europe and is probably the most important of all the egg parasites.

It may be found in either green or dry stems of alfalfa; when found in the latter it feeds more frequently upon the eggs of the clover-leaf weevil (*Hypera punctata*). Adults issuing from egg masses of the clover-leaf weevil are usually much larger than those from alfalfa weevil egg masses, which is probably due to the plentiful food supply. Their larvae are found feeding on egg masses in the field from January to July according to the locality, and from January to May at Hyères. Nothing is known of the number of generations since we were unable to rear the species in the laboratory or determine its life cycle by field observations.

[1]Determinations of the Chalcidoid parasites by A. B. Gahan, of the Ichneumonid parasites by R. A. Cushman.

The highest parasitism by this insect was found in a field of growing alfalfa at the edge of Hyères in January and February, 1923. This high parasitism, 10 to 30 per cent, was in part due to the fact that the alfalfa was allowed to stand untouched during the oviposition period of the weevil, which in this locality seems to lie mainly between the middle of December and the middle of February. Since the growth of the alfalfa was very slow at this time, it permitted the accumulation of a great number of eggs of the host upon which the parasite could work. Ordinarily at this time the alfalfa is closely grazed by sheep, with unfortunate results for both the host and its parasite.

We have reared this parasite from material taken at Hyères, Tournon, Evires, and near-by localities in France, and from Acerra, Portici, Montecorvino, Piedimonte d'Alife, and near-by points in Italy, and from Milazzo, Sicily. They were found near Naples, Italy, Milazzo, Sicily, and Le Luc, France, in 1913. Small numbers of predatory larvae which were not reared to maturity, some of which may represent this species, were secured from other localities in France, including Chambéry, Annecy, Champagnole, and Lons-le-Saunier.

Spintherus sp.

This pteromalid parasite proved very rare during the seasons of 1922 and 1923. Its habits, so far as known, are similar to those of *Peridesmia phytonomi*, its larvae feeding externally upon the egg masses. It seems to be the dominant species in all the higher and colder regions of France. It was taken during the years mentioned from Evires and Servoz (Higher Savoy), from Lons-le-Saunier and Champagnole (Jura), and in 1913 from Milazzo, Sicily.

Eupelminus excavatus Dalm.

The larva of this eupelmid also feeds externally upon the eggs of *Phytonomus posticus* and *Hypera punctata*. Although it was taken during the last two years only from the country around Naples, in 1913 it was found in material from Le Luc, France, and Milazzo, Sicily. Normally the larvae of this species aestivate in the stems of alfalfa and issue in the autumn. In the small amount of experimentation done in the laboratory with this insect we have not been able to breed it upon eggs of *Phytonomus*. This parasite was more common in the importations of 1913 than was *Spintherus* sp. but less so in material examined in Europe in 1922 and 1923.

Other Pteromalids

At least two other pteromalids have been obtained from alfalfa stems and in our own experience they have been associated with *Peridesmia*

phytonomi. These have been designated as Pteromalids "C" and "D." Pteromalid "D" appears to be the more common of the two in the Hyères country, and may be a primary parasite, but probably as many as one hundred predatory larvae which had been fed upon *Phytonomus* eggs in wooden cells in the laboratory failed to produce this species either as a primary or secondary parasite.

Anaphoidea luna Girault.

This mymarid is an internal parasite of the egg of *Phytonomus posticus* and *Hypera punctata*. Thus far it appears unimportant as a destroyer of eggs in green stems, but in dry stems it is much more effective. This is probably because the parasite can enter the dry stems and place eggs in the greater part of the host eggs, whereas in green stems it can only oviposit in one or two of the eggs next the egg puncture of the host. It oviposits to an equal extent in the eggs of *H. punctata* and very often, probably most of the time, places two eggs in each egg of the clover-leaf weevil, whereas in the egg of the alfalfa weevil only one is inserted. The parasites from eggs of the clover-leaf weevil are considerably larger than those from the alfalfa weevil, whether one or two come from a single egg. This insect breeds quite readily in confinement. We have taken it from the environs of Hyères, France; Naples, Italy, and Milazzo, Sicily.

Parasites of the Larvae

Bathyplectes curculionis (Thoms.)

This internal parasite of the larva breeds freely in the laboratory on all sizes of larvae and is the chief parasite which has been colonized in Utah. It appears to be generally distributed over Europe where the weevil occurs. We have taken it from Lons-le-Saunier, Annecy, Chambéry, Gap, Valence, Digne, Blois, Aix-en-Provence, and Hyères, all in France, and from Bevagna, Acerra, Portici, Piedimonte d'Alife, and other places in Italy, and from Sicily. It is probably the most important of the larval parasites in Europe. Occasionally and locally parasitism by another parasite may exceed that by *Bathyplectes curculionis*, but the average parasitism over large areas has always been highest for this species. It is itself parasitized by many species, chief among which are *Mesochorus nigripes* Ratz. and *Gelis stevenii* (Grav.)

Bathyplectes corvina (Thoms.)

This parasite of the larva is similar in habits to *Bathyplectes curculionis*, but it has only one generation a year. It is much more difficult to handle in the laboratory than *B. curculionis* because most of the insects die within their cocoons when kept in confinement. Whereas

Bathyplectes curculionis passes the winter as a larva within its cocoon, most of the individuals of *B. corvina* pupate in the fall and pass the winter in that stage or as adults inside the cocoons, unless they have been kept in cold storage throughout the summer and winter; in the latter case most of them remain as larvae. In field-collected cocoons kept in the Hyères laboratory in the summer of 1922, many perfectly formed adults were found in the fall but there were no issuances from the cocoons until spring. Although in general this species seems less important than *B. curculionis*, it appeared to be the dominant species in some localities in 1922 and 1923. This was true of the Hyères section. We have found *B. corvina* in practically all the regions in which we recovered *B. curculionis*.

This parasite also is parasitized by many other insects, chief among which is *Mesochorus nigripes*, as in the case of *B. curculionis*.

Bathyplectes tristis (Grav.)

This species is an internal parasite of the larvae of *Phytonomus posticus* and *Hypera punctata*. We found it very scarce in our material collected in 1922 and 1923. There is probably one generation a year. This insect is parasitized by other species, chief among which is *Mesochorus nigripes*. The writer has reared what is believed to be *Bathyplectes tristis* from an undetermined weevil collected from wild alfalfa at Hyères, France.

Tetrastichus incertus (Ratz.)

This eulophid parasite of the larva was collected chiefly in 1922, from the neighborhood of Piedimonte d'Alife, Italy. Of 6,647 larvae from this region, 4,737, or 71.2 per cent, were parasitized by it. Dissected larvae were found to contain from 6 to 17 parasite larvae each. It was proven to be a primary parasite by breeding it upon nonparasitized laboratory-hatched weevil larvae. A small number of these eulophids in prepupal larvae were found to be parasitized externally by a eupelmid parasite, *Eupelmus atropurpureus* Dalm.

This parasite was found in small numbers in material from Switzerland in 1913, and we took a few from material from Montmélian, France, in 1923.

Parasites of the Prepupae and Pupae

Dibrachoides dynastes (Först.)

This external parasite of the prepupae and pupae of the weevil was bred upon nonparasitized prepupae and pupae by T. H. Parks, E. J. Vosler, P. H. Timberlake, and the writer. While in general it seems to prefer prepupal hosts, it will at times breed just as readily upon the

pupae. From one to six parasites have been reared to maturity upon a single host. This is probably the most important of the prepupal and pupal parasites in Europe, but owing to the variability in effectiveness of different parasites from year to year, it is difficult to make sure of this. It was taken in 1922 and 1923 from Hyères, Tournon, and Lons-le-Saunier, in France, and from points around Naples, in Italy. It is parasitized to a small extent by a eulophid, *Pleurotropis* sp., which in the laboratory oviposits in the pupae of *D. dynastes* but not in the larvae.

Necremnus Leucarthros (Nees)

We have reared and bred upon *Phytonomus* prepupae a eulophid parasite which appears to be *Necremnus leucarthros* (Nees). On Phytonomus hosts, the habits of the insect are similar to those of *Dibrachoides dynastes*. In the laboratory as many as 41 eggs have been laid upon a single host but only a few of these matured. As many as 18 well developed adults have been secured from a single prepupa. No secondary parasites have been reared from it. The species was taken from material from the country near Naples in Italy and from Tournon and the high regions about Chambéry in France.

Parasites of the Subfamily Cryptinae

The recorded parasites belonging to the subfamily Cryptinae, *Aenoplegimorpha micator* (Grav.), *Hemiteles graculus* (Grav.), and *Spilocryptus pumilis* Kriechb., have not proven very important in our experience. In Europe in 1923, when most of the parasites of the subfamily Cryptinae were found, *H. graculus* and an undetermined parasite belonging to the tribe Gelini were the only members of the subfamily Cryptinae which were found in any considerable numbers. *H. graculus* was more common in Italian material in 1923 than in 1913, but even then rare. In our experience *H. graculus* bred freely in the laboratory and was reared from egg to adult in 15 days in June. In addition to the parasites of this subfamily mentioned above two other species have been found in cocoon material but it has not been proven whether they are primary or secondary. These are *Spilocryptus* sp. and *Hemiteles* sp.

Practically all the parasites belonging to the subfamily Cryptinae studied in 1922 and 1923 came from Italy near Naples.

Itoplectis maculator (Fab.)

This is an internal ichneumonine parasite of the prepupae and pupae of *Phytonomus*. The writer has been able to obtain only a few undersized specimens of the species by breeding in the laboratory, but it undoubted-

ly can act as a primary parasite on *Phytonomus*. In the laboratory most of the hosts were so thoroughly stung by the female that they died before the parasites developed. Hosts, similar in appearance to those killed in this way in the laboratory, have been collected in the field. A few eggs and larvae have been dissected from hosts apparently in all other ways healthful. We have reared from a small number of *Phytonomus* pupae a black pteromalid, *Catolaccus ater* Ratz., which probably had parasitized *Itoplectis maculator*.

We have taken this insect from Hyères, Tournon, and Lons-le-Saunier, France, and Piedimonte d'Alife and Naples, Italy.

Distribution of Parasites in Southern Europe

As is well known, one larval parasite among the list given, *Bathyplectes curculionis* (Thoms.), is well established in the weevil-infested territory in the United States, and parasitism by it there exceeds any of which we have record in the Old World. The question naturally arises whether or not some of the other parasites in the list which may appear more or less obscure in their present environment may not be able to increase in importance after colonization in this country. As our investigations have shown quite clearly, we believe, that the agricultural systems there prevailing have much to do with the relative scarcity of the weevil in Europe, we would like to know what the effect of other introduced weevil parasites will be if they can be colonized in Utah and near-by states where cultural systems have apparently failed to hold the weevil in check.

Among the most promising of the parasites studied in Europe are the egg parasites *Peridesmia phytonomi*, *Spintherus* sp., and *Anaphoidea luna;* the larval parasites *Bathyplectes corvina* and *Tetrastichus incertus;* and the pupal parasites *Dibrachoides dynastes* and *Necremnus leucarthros*. Of special significance, however, from the standpoint of their possible introduction into the United States is the distribution of these parasites, for some of them have been thought to be southern insects probably incapable of existing in a climate similar to that of Utah.

It will be remembered that *Peridesmia phytonomi* was found, among other places, at Hyères and Evires. Hyères is the most southerly point in the French Riviera. Frost rarely occurs there and alfalfa grows practically throughout the year when sufficient moisture is available. Date palms, figs, and mandarins also are grown there. Evires, on the other hand, is a village in Higher Savoy with an altitiude of about 2,500 feet and with short summers and long winters. It is in one of the

coldest and highest sections in that region in which alfalfa can be grown.

Spintherus sp. was found at Milazzo, Sicily, in 1913, and at Servoz, Lons-le-Saunier, and Champagnole, France, in 1922 and 1923. Milazzo has a warm climate. West of Milazzo along the north coast of Sicily much of the land is given to the cultivation of citrus fruits. Champagnole represents the highest and coldest section in that general locality in which alfalfa can be grown. It is at an altitude of about 1,800 feet. Servoz is in Higher Savoy, near Chamonix, at the foot of Mont Blanc, and has an altitude of about 2,700 feet. This also is about the highest and coldest section in which alfalfa is grown there. It should be remembered in this connection that *Spintherus* sp. appears to be the dominant species in the cold country, though, as stated, *Peridesmia phytonomi* also occurs.

Anaphoidea luna seems to be more restricted in range than either of the preceding, but is important on account of its work in dry stems.

Both of the larval parasites *Bathyplectes corvina* and *Tetrastichus incertus* have a considerable range. *Bathyplectes corvina* was found practically wherever the alfalfa weevil occurred and seems to be the dominant species in some regions. *Tetrastichus incertus* was not found as commonly as *Bathyplectes corvina*, but it occurred in Switzerland outside Zurich in 1913, at Piedimonte d'Alife, Italy, in 1922 and 1923, and near Montmélian in Savoy, France, in 1923. One of the most significant facts about *T. incertus* is the extent to which it parasitized the alfalfa weevil larvae in Piedimonte d'Alife, Italy, in 1922. This parasitism, 71.2 per cent, exceeds that of any other insect parasite of the alfalfa weevil we have found in Europe and serves to show how important a seemingly inconspicuous parasite may become when the proper conditions are present.

Dibrachoides dynastes was found at Hyères, at Tournon (near Valence in the Rhône Valley), and at Lons-le-Saunier, France, and at Naples, Italy. Lons-le-Saunier is near Champagnole but at a lower altitude. *Necremnus leucarthros* has been taken from the country near Naples, Italy, and from Tournon and the high regions about Chambéry, France.

Summary and Conclusions

The alfalfa weevil is controlled to a large extent in Europe by cultural practices and climatic conditions, but wherever it occurs it is parasitized to a greater or less extent by insects. The parasites considered most important during the two years spent by the writer in France were the egg parasites *Peridesmia phytonomi*, *Spintherus* sp.,

and *Anaphoidea luna;* the larval parasites, *Bathyplectes curculionis*, *Bathyplectes corvina*, and *Tetrastichus incertus;* and the prepupal and pupal parasites, *Dibrachoides dynastes* and *Necremnus leucarthros*.

With the exception of *Anaphoidea luna*, all these parasites were shown to be able to live under a rather large range of climatic conditions. In view of this fact, it seems probable that most of them could survive a climate like that of Utah, and leaving out of consideration the possible need of undiscovered alternate hosts for some of them to complete their life cycle, it seems practicable to colonize all of them. There is a considerable difference in the extent of parasitism by these species in different seasons and sections, and in different fields in the same section, doubtless owing in part to the effect of climate, cultural systems, and disease upon the numbers of the host. Neither cultural systems nor diseases appear to check the alfalfa weevil in the United States to as great an extent as in Europe. The greater numbers of weevils present, therefore, may afford a better opportunity for the work and multiplication of parasites and increase their effectiveness, as seems to have been the case with *Bathyplectes curculionis*.

THE POSSIBILITIES OF WEEVIL DEVELOPMENT IN NEGLECTED SEEDS IN WAREHOUSES*

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Abstract

Bean growers as well as commercial bean warehouses usually keep lots of beans and cowpeas over the summer. Such lots of seeds furnish ideal breeding places for the common bean weevil, *Bruchus obtectus*, and for the four-spotted cowpea weevil, *B. quadrimaculatus*. They frequently become weevily and furnish the chief source of weevil infestation for the growing crop. Heavy infestations in the field have been traced directly to small lots of weevily seeds.

The experiments here recorded show that several broods of weevils may develop in a small lot of seeds. Most of the weevils fly away in search of new material on which to oviposit, but enough remain among the original seeds to keep up the infestation until practically all the available food has been removed. Sixty-nine pounds of black-eyed cowpeas produced approximately 368,000 emerged weevils or 4½ adults for each seed, and were reduced 62 per cent in weight.

Bean growers frequently have small lots of beans of one or more varieties left over after the spring planting is completed. Because they

*In this article any storehouse about the farm is considered a warehouse as well as all commercial bean warehouses.

are only small quantities, they are not marketed but are stored to be used for seed the next year or to be mixed with the new crop and sold. Bean screenings and other small lots of beans may also be kept over the summer in some of the out-buildings about the farm. These beans frequently become weevily and are overlooked until they are practically ruined. Even in large commercial bean warehouses lots of weevil infested beans are held during the summer. Such infested seeds furnish the chief source of weevil infestation for the growing crop. They not only become unmarketable but they furnish material in which weevils are able to continue their development throughout the summer.

In order to determine the potential possibilities for infesting a new crop, by securing information bearing on the approximate number of weevils which may emerge in storage and the time these weevils would fly from storage in search of new beans upon which to oviposit, as well as the duration of such infestations under conditions comparable to those obtaining in barns or other out-buildings on farms of Southern California, the writers infested a part of a bag of black-eyed cowpeas with the four-spotted cowpea weevil, *Bruchus quadrimaculatus*.

On July 13, 1923, 25 pairs of *B. quadrimaculatus* were placed in an ordinary bean sack containing 69 pounds of "choice recleaned" black-eyed cowpeas. The bag was placed on a table inside of an insect cage built for this purpose. The cage was 8 x 6 feet and 6 feet high with a narrow door in one end. The top was covered with muslin. An 18 inch strip of 16 mesh wire screen was placed around the entire upper and lower part of the cage; a 38-inch strip of muslin placed around the middle of the cage allowing an inch to lap over the upper and lower wire strips completed the covering. The screen wire and cloth were fastened securely with cleats at the edges. The door was covered with screen. This cage was thought to furnish conditions quite similar to those in many of the out-buildings and sheds in which left over bags of beans are stored in California. The out-door temperature was recorded in a screened insectary adjoining the cage on the south side; the daily means are recorded in Chart I. During the summer a piece of compo board was laid over the sack but later a window was put over it to keep off the rain.

Throughout the experiment the weevils were counted as they were caught in small glass vials containing kerosene. Weevils at large in the cage were recorded daily for the most part. It will be appreciated that the date of capture indicates only the time when the weevils left the

sack of cowpeas in search of new material upon which to oviposit, and not necessarily the actual date of emergence in the sack.

Daily examination indicated that the original 25 pairs of weevils showed little inclination to search for a new supply of food in which to breed. Only 5 specimens, 3 males and 2 females, were found on the walls of the cage. The last living adult was noted on July 27th.

Adults of the first brood were noted first on August 9th, when one weevil was found on the walls of the cage. The peak of emergence of this brood occurred between August 20 and 25th. During this time approximately 1,600 weevils were caught about the cage. Practically all of these weevils remained inside of the cage because most of them were too large to go through the interstices of the 16 mesh screen. Apparently a large proportion of the females of the first brood laid eggs before leaving the infested bag of seeds in search for new material.

The daily catch of weevils became smaller and smaller until only 15 were taken on September 5th. After that date the numbers again began to increase indicating that a second brood was emerging.

The flight peak of the second brood was reached between September 18 and October 2. During this period 54,138 weevils were recorded, 1,528 of which were caught on the outside of the cage. Eggs distributed on ripening pods in the garden nearby, indicated that a large number of weevils had escaped.

Larson and Simmons[1] pointed out the fact that a heavy infestation of weevil may raise the temperature of the cowpeas within a bag 35°F. above the surrounding room temperature. During the period of heavy emergence, between September 18 to October 2, the temperature of the cowpeas remained near 100°F. both day and night. This high temperature appeared to cause the emerging weevils to leave the bag, soon after emerging. This was especially noticeable during warm mornings and continued until the atmosphere began to cool. As night approached with its marked and rapid lowering of temperature all weevils about the cage sought the warm shelter of the bag of cowpeas. This became more marked as winter advanced with its warm or hot days and its cool or cold nights.

The third brood of weevils appeared to reach its maximum during the latter part of October. The weevils of this brood were noticeably smaller than those of the earlier broods, consequently a larger percentage of them escaped through the screen wire of the cage.

[1]Insecticidal Effect of Cold Storage on Bean Weevils, Journal of Agricultural Research. Vol. XXVII, No. 2, January 12, 1924.

In addition to the mean daily temperature, Fig. 18 records the number of weevils emerging during five day periods from August 9, 1923, to March 14, 1924, the dates of the first and last catch respectively. These

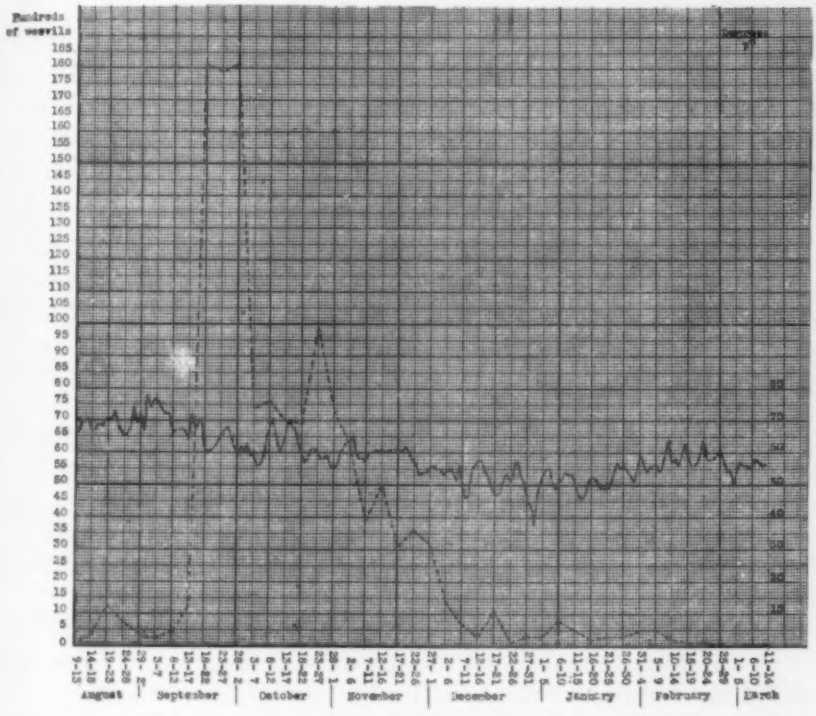

Fig. 18.—Record (broken line) of the number of Bruchids captured during five-day periods between August 9, 1923, and March 14, 1924. Daily mean temperatures for periods shown by solid line.

periods do not necessarily correspond with the dates during which the peak flights occurred as the peak flights could have been on the last two days of one period and on the first three of the next or vice versa. The chart shows distinctly the flight periods of the first, second and third broods. It was thought that after the majority of the third brood emerged there would be such an overlapping of generations that it would be impossible to determine when the third ended and the fourth began or when any later brood began. As a matter of fact, after the third brood had emerged there was left in the seeds so little food that the lack of food alone would have greatly retarded successive weevil de-

velopment, even had unfavorable winter weather not intervened. This absence of food prevented later heavy infestations.

From the 69 pounds of black-eyed cowpeas (original weight) 137,233 emerged weevils were recorded as having been caught about the cage. At the end of the experiment the dead weevils loose among the seeds in the bag were measured; from an actual count of a smaller measured lot the total number of adult weevils that had emerged and died within the sack was estimated at 56,100. This makes a total of 193,333 adult weevils that were recorded.

At the close of the experiment the 69 pounds of cowpeas had been reduced to 26¼ pounds, a loss of about 62 per cent. There was also 15 ounces of frass scattered free within the bag.

It required 3,150 of these weevil eaten cowpeas to make a pound, therefore, 82,687 cowpeas were contained in the 26¼ pounds within the bag. This would indicate that at least 2-⅓ weevils had emerged from each cowpea. A count of the emergence holes showed that 445 weevils or about 4-½ per seed had emerged from 100 cowpeas. On this basis it would appear that 367,957 weevils had emerged, of which 174,624 had escaped unrecorded. It was known that after the first generation, large numbers were escaping. Thousands of weevils were also lost in the loose dirt on which the cage was standing, so it is believed that an estimate of 4.45 weevils per cowpea is not too high an estimate of the number produced.

That practically all of the food material was eaten out of the cowpea was shown when a number of the cowpeas were dissected. It was impossible to determine the number of dead larvae that were contained within the seeds because the small larvae after drying could not be separated from the frass within the cowpeas. The dissection of 100 cowpeas showed 138 dead pupae and adults which apparently had starved to death before becoming fully developed. On that basis 114,108 pupae and adults had died within the seeds. It is probable that several times as many young larvae died for want of food.

Several undetermined species of spiders lived about the cage and preyed to some extent on the weevils. Only 210 adults were recorded as having been killed by spiders.

Observations in the field indicate that weevily beans and cowpeas left neglected about storage places are practically the only source of infestation for growing crops.

While inspecting lots of beans as they were being delivered to a warehouse at Puente, California, the senior writer came across a lot of weevily

black-eyed cowpeas which had been grown at Spadra, a section which had previously been free from weevils. There were only a few bean growers in Spadra but that year, 1922, they all produced weevily beans. Investigation showed that one grower after completing his planting in the spring had left his bean planter about half full of black-eyed cowpeas. These cowpeas had been purchased at a warehouse where some seeds were badly infested with *Bruchus quadrimaculatus*. The seed although showing no weevils at planting time must have contained some undeveloped weevils because those in the bean planter when found in August were heavily infested. In this instance a few neglected cowpeas were the direct cause of a serious loss not only to the owner of the neglected seeds but to his neighbors as well.

Other instances where badly infested crops could be traced directly to neglected lots of seeds have come under the writers' observations at Puente, Chino, and Modesto, California.

Weevily lots of beans and cowpeas should be fumigated or heated to kill the weevils, and should then be fed to hogs or poultry or should be destroyed. All lots of beans and cowpeas should be examined frequently to insure against an outbreak of weevils.

A SUPPOSEDLY BENEFICIAL INSECT DISCOVERED TO BE A CITRUS PEST

By A. J. BASINGER, *Citrus Experiment Station, Riverside, California*

ABSTRACT

Holcocera iceryaeella Riley which was formerly recorded as a scale predator and scavenger is found also to be a secondary feeder on oranges, causing damage similar to that of *Tortrix citrana* Fer.

During our investigation of the Orange Tortrix the larva of another species of moth has been found doing damage to oranges similar to that of *Tortrix citrana* Fer. Specimens of this moth were sent to Mr. August Busck, specialist in Lepidoptera, United States Department of Agriculture, Bureau of Entomology and he determined them as *Holcocera iceryaeella* Riley. He expressed surprise that this insect should be found injurious to oranges and stated in his correspondence as follows:

"This species (*Holcocera iceryaeella* Riley) is supposed to be actually predaceous on the scale insects and hence a beneficial insect. The entire genus is composed of species more or less scavenger or secondary feeders."

This moth was first taken in 1886 in the vicinity of Los Angeles by Albert Koebele who was then a special agent for the United States De-

partment of Agriculture working on methods for the control of the cottony cushion scale. He sent specimens to C. V. Riley (1), Chief of the Bureau of Entomology, who described them in the same year as *Holcocera iceryaeella*. Koebele reported the larvae as feeding on living black scale and on dead cottony cushion scale. The next account we have of this insect is in 1916 in a short paper by E. O. Essig (2) entitled "A Coccid Feeding Moth." Essig records it as occurring on the campus of the University of California in Berkeley and finding it most abundantly on a sweet bay tree, *Laurus nobilis* Linn., which was severely infested with the greedy scale, *Aspidiotus camelliae* Sign. He lists as hosts in addition to the black scale, *Saissetia oleae* (Bern) and the cottony cushion scale, *Icerya purchasi* Mask., the following: European peach scale, *Lecanium persicae* (Fab.), the greedy scale, *Aspidiotus camelliae* Sign., and Baker's mealybug, *Pseudococcus bakeri* Essig. It is also recorded by Horton (3) in 1918 as a mealybug predator.

The larvae when full grown are 7 to 9 mm. in length. They are brownish gray with longitudinal stripes of a lighter color and have a brown to shiny black head and prothoracic plate. In habits they are moderately irritable and occupy nests made by webbing together bits of trash such as old blossoms that have fallen and collected on a leaf. Or they may occupy an old curled leaf or an abandoned Tortrix nest. Often they locate between oranges where they make a nest and feed on the fruits.

The adult is a small gray moth from 6 to 8 mm. long with a wing expanse of about 15 mm. When at rest the wings are folded straight back giving the moth a linear appearance, being only a little wider toward the posterior end than at the head. Across each forewing there is an oblique line of a lighter color. These lines form a V-shaped mark on the back when the wings are folded.

The forewings are fringed on the tip and outer half of the hind margin. The hind wings are fringed clear around but the fringe on the hind margin is extra long.

The pupae are scarcely 5 mm. long and are like small dark brown grains of wheat with the abdominal segments quite closely compressed. They are found within the larval nests.

The injury to the fruit is similar to the work of *Tortrix citrana* but the holes and channels into the orange are, as a rule, not quite so deep and pronounced. I have repeatedly taken these larvae from nests on oranges and found the fruit damaged beneath and on several occasions have taken full-grown larvae from their tunnels where they had bored

out of sight under the orange peel. As a further test I placed some larvae in small individual cages on oranges hanging on the trees and found that most of the larvae fed on the fruits.

These moths occur in Orange and Los Angeles Counties together with *Tortrix citrana* Fer. There are some *Holcocera* present in practically all orange groves but the trees that are dirty because of scale insects are apparently more heavily infested. In Orange County, at present, there are more *Holcocera* than *Tortrix*.

This is not a new insect as we learn by its history but it seems to have digressed from its original habits of scavenger and predator on scale insects to a secondary feeder on oranges where it occurs in the citrus districts. *Tortrix citrana* and *Platynota tinctana* Walker have received the blame for the wormy oranges in Southern California but I am sure that *Holcocera iceryaecella* has been responsible for some of the damaged fruits, perhaps for most of the wormy oranges that formerly were supposed to have been caused by *Platynota tinctana* Walker, which I have found too sparingly in the citrus areas of Los Angeles and Orange Counties during the past year to even cause a noticeable amount of wormy fruit.

REFERENCES

1. RILEY, C. V. Report Comm. Agri. 1886, 485, 1887.
2. ESSIG, E. O. Jour. Ec. Ent., 9, 369, 1916.
3 HORTON, J. R. U. S. D. A. Bul. 647, 30, 1918.

CAUSES OF FLUCTUATION IN NUMBERS OF BEET LEAFHOPPERS (*EUTETTIX TENELLA* BAKER) IN A NATURAL BREEDING AREA OF THE SAN JOAQUIN VALLEY IN CALIFORNIA

By HENRY H. P. SEVERIN, Ph.D., *California Agricultural Experiment Station*

ABSTRACT

The primary cause for the enormous increase of the beet leafhoppers during 1919, hinges on two factors: (1) there were no summer migrations of the pest during 1918, so that a large number of eggs were deposited during the autumn; (2) the nymphs which hatched from these eggs found an abundance of green food not only in the cultivated areas but also on the plains and foothills after the heavy September rains germinated the seeds of the vegetation.

The factors associated with the reduction in numbers of the beet leafhoppers vary in different years. The primary cause for the enormous reduction in numbers of the spring brood hoppers on the plains and foothills during 1923, was due to the early drying of the pasture vegetation during March instead of April and May as in previous years from 1919 to 1922. Secondary factors which reduce the number of leafhoppers in a natural breeding ground are natural enemies, spring and summer migrations, fungus diseases and rainfall.

Periodical Outbreaks

According to Ball (1) the periodical outbreaks of the beet leafhopper west of the Rocky Mountains occurred during 1899–1900, 1905, either 1914 or 1915, and east of the Rockies in 1903 and 1908.

In California the most reliable records of the outbreaks of curly leaf date back to 1899 at King City in the Salinas Valley. The periodicity of the beet leafhopper and the interval between outbreaks may be shown as follows:

1899–1900, 1905, 1913–1914, 1918–1919–1920–1921–1922
4 7 3 years.

It is evident that, with the exception of 1905, the outbreaks of the beet leafhopper occurred twice in two successive years and once in five consecutive years. An examination of the number of acres planted, the acreage abandoned, and the tonnages harvested indicates that when blight occurs in two successive years, the drop in tonnage due to the disease is greater in the second year. During the years 1918 to 1922, curly leaf caused greater losses during 1919 and 1921, than in 1918, 1920 and 1922, when the acres abandoned are taken into consideration. The largest losses were sustained during the second year in 1919.

Factors Favorable for Increase of Beet Leafhoppers

What are the factors associated with the severe outbreak of the beet leafhopper during the second year? On September 11 to 13, 1918, heavy rains fell in the San Joaquin and Salinas Valleys, germinating the seeds of the pasture vegetation on the plains and foothills, and a new growth of weeds developed in the cultivated areas. During the autumn the saltbushes and other favorable host plants of the leafhopper normally become dry and the nymphs which hatched from eggs deposited in the fall by the females of the summer broods now found an abundance of food in this new growth of vegetation in the cultivated territories. These nymphs acquired the winged stage subsequent to October and November after the return flight of the dark winter adults to the plains and foothills. During the winter these stragglers which remained behind in the cultivated districts congregated on the very earliest planted beets in the northern part of the San Joaquin Valley and one-half of the 1919 crop showed curly leaf symptoms before the enormous numbers of pale green leafhoppers of the spring brood flew from the plains and foothills into the cultivated regions during April. According to Mr. W. W. Thomas, over one-half of the beet crop was blighted at King City (Ranch 3) by

the overwintering brood before the spring generation invaded the beet fields.

The writer (3) has published the fact that nymphs were also taken during November and December, 1918, on Red Stem Filaree (*Erodium cicutarium*) growing on the foothills of the San Joaquin and Salinas Valleys. These nymphs hatched from eggs deposited in Red Stem Filaree by the summer brood females and not by the dark overwintering forms.

The Weather Bureau reports for Stockton, situated in the northern part of The San Joaquin Valley, show that there were only five years in which the September rainfall was more than one inch during the past 74 years, as follows: 1894—1.76; 1899—3.59; 1904—2.27; 1912—1.39; and 1918—3.68 inches. It is evident that heavy September rains fell during 1899, 1904 and 1918, and were followed in the next year by severe outbreaks of curly leaf. The year 1913 is the only exception in which a trace of rainfall recorded for September and October was followed by serious damage from curly leaf during the following year 1914, but September rains recorded for 1912 preceded the outbreak of blight in 1913. In the Salinas Valley an abundance of rain fell at King City during the autumns of 1913 and 1918, preceding the serious outbreaks of curly leaf during 1914 and 1919.

On the other hand, when no large amount of green vegetation is available in the cultivated areas during a dry autumn, the number of stragglers is greatly reduced and a low percentage of curly leaf occurs in early planted beet fields during the winter. During September, 1917, .14 inches of rain fell at Manteca, and 4 per cent of the early planted crop was affected with curly leaf in the northern part of the San Joaquin Valley before the pale green adults of the spring brood flew into the beet fields during April, 1918. Again in 1919, .49 inch of rain fell in September, and about one beet in a thousand showed the disease symptoms before the pest invaded the beet fields during April, 1920. No rains fell during September, 1920, and an average of 5 per cent of the early planted beets were blighted before the spring dispersal of the first brood from the plains and foothills into the cultivated areas occurred in April, 1921.

Although the dark winter brood adults which remained behind in the cultivated areas caused curly leaf in half of the crop of the earliest planted beets in 1919, nevertheless, the most serious factor associated with the severe outbreak of the disease is the enormous hordes of pale green leafhoppers which invaded the beet fields during April. Al-

though it is commonly supposed by agriculturists and fieldmen that a good crop can be obtained when the foliage of sugar beets covers the rows or shades the ground by the time that the adults of the spring brood fly into the beet fields, the writer is fully convinced after the outbreak of curly leaf in 1919 that such is not always the case.

The primary cause for the enormous increase in numbers of the beet leafhoppers during 1919 hinges on two factors: (1) there were no summer migrations of the pest during 1918, so that a large number of eggs were deposited during the autumn; (2) the nymphs which hatched from these eggs found an abundance of green food not only in the cultivated areas but also on the plains and foothills after the heavy September rains germinated the seeds of the vegetation.

Factors Concerned with the Reduction in Numbers of Beet Leafhoppers

Early Drying of Pasture Vegetation.—It was frequently observed in the San Joaquin Valley that heavy north winds dry the pasture vegetation rapidly on the plains and foothills during April and May. In all probability, when the pasture vegetation becomes wilted and begins to dry, large numbers of eggs of the beet leafhoppers fail to hatch, as is the case when Red Stem Filaree, weeds and sugar beet leaves wilt and become dry in the greenhouse.

An examination of the climatological data of the Weather Bureau Office during 1923 shows that February was the driest in 11 years and the driest March in 27 years in California. Drought conditions continued for a period of six consecutive weeks, from the middle of February to the close of March. Desiccating northerly winds prevailed during March.

The primary cause for the enormous reduction in numbers of the spring brood leafhoppers on the plains and foothills during 1923 was due to the early drying of the pasture vegetation during March instead of April and May as in previous years from 1918 to 1922. Mr. E. A. Schwing, Entomologist for the Spreckels Sugar Company Agricultural Experiment Station, reports that the plains and foothills of the southern and middle sections of the San Joaquin Valley were almost entirely free from hoppers except on the floor of Little Panoche Valley, where such nymphs as did hatch were forced to congregate on green pasture vegetation growing in the drainage furrows. Records taken in previous years in Little Panoche Valley showed that the nymphs and adults assemble on green pasture vegetation in the drainage furrows during April and May.

NATURAL ENEMIES.—There are several secondary factors which reduce the number of beet leafhoppers in a natural breeding area. In all probability, the most important of these are the natural enemies of the leafhopper, a subject which has already been discussed in a previous paper (6). No information is at hand as to the value of egg parasites on the plains and foothills, and until more is known concerning these beneficial insects, Hartung (2) is hardly justified in stating that the problem of periodicity is associated with the fluctuation in the number of egg parasites.

SPRING MIGRATIONS.—Spring migrations reduce the number of beet leafhoppers in a natural breeding area.

SUMMER MIGRATIONS.—Summer migrations may deplete to a large extent the natural breeding grounds of the beet leafhopper; the nymphs and adults which remain behind are then hard-pressed by parasites and predaceous enemies. The observations on the summer migrations from the San Joaquin Valley during 1919 have not been published and the details follow.

A trip was taken to the southern part of the San Joaquin Valley on July 24 to 25, with Mr. J. W. Hartung, and it was found that a summer migration of the pest had occurred. In the Connor and Corcoran beet districts the sugar beets not harvested were mostly dead owing to curly leaf, but the adults were scarce on the green innermost leaves with dried outer foliage of such beets as could be found. Sweepings were made on some of the most favorable host plants, such as the saltbushes growing in and along the margin of beet fields, but the leafhoppers had not assembled on these plants. During April and May, thousands and thousands of hoppers were found on various species of Atriplex, but in July it was difficult to secure 100 adults on these same plants to determine the percentage of parasitism.

In the middle portion of the valley the beet leafhoppers were extremely abundant on Russian Thistles and various saltbushes during the spring, but on July 26, the adults were rare on these plants growing in irrigated fields. Along the roadsides and in the fields that had not been irrigated the Russian Thistles attained a few inches of growth and died, owing to a shortage of rain and probably also to the drain of enormous hordes of bugs.

In the northern section of the San Joaquin Valley enormous numbers of adults had congregated on June 26, on Bractscale (*Atriplex bracteosa*) growing among blighted sugar beets in the vicinity of Hatch Station. The foliage of these saltbushes was covered with droplets of clear

excrement which glistened in the sunshine. When a person walked past one of the weeds, so that a shadow was thrown on the plant, a swarm of hoppers flew up. Nymphs were still abundant on sugar beets with green innermost leaves and dried outer foliage. Our next visit to these beet fields on July 5 showed that most of the insects had left saltbushes and that a summer migration had occurred. Another assemblage of the leafhoppers was observed on Bractscale on July 26.

FUNGUS DISEASES.—In years with an abundance of rainfall fungus diseases may play an important rôle in the reduction in numbers of the pest in certain parts of a natural breeding ground, such as the northern part of the San Joaquin Valley (4). It was found, however, in the fog belt of two counties that the beet leafhopper succumbed to a fungus disease during the dry season (5).

RAINFALL.—The writer (3) has published the fact that heavy rainfall kills some of the beet leafhoppers, but in all probability, is a minor factor in the reduction of the number of adults.

PREDICTING OUTBREAKS

According to Ball (1) "any information by which the probable occurrence of these periodic outbreaks could be foretold would, therefore, be worth millions of dollars to this industry. It is probably more important to be able to say that there will be no flights to a given region during a season than to predict the probability of such occurrence."

It is evident that accurate predictions can be made in the reduction in numbers of the spring brood beet leafhoppers in a natural breeding area with the early drying up of the pasture vegetation. This prediction can be made safely during March. This information, however, is of no practical value in the interior regions of California, where early planting should be practiced. In the fog belt, where late planting should be practiced, the information may be of practical importance.

If the factors associated with an increase of the beet leafhopper were accurately determined, the prediction of an outbreak of the pest could not be made until after the spring brood hoppers appear on the plains and foothills. The prediction can be made safely during April, in natural breeding grounds, but in the interior regions of California the beets would have been planted previous to the spring dispersal, if early planting was practiced. The information in regard to the presence of large numbers of hoppers on the plains and foothills would be of no accurate value in the fog belt, for the insects will not invade the coast regions, if fogs are present at the time that the spring flights occur, but will enter this area when fogs are absent.

BIBLIOGRAPHY

1. BALL, E. D., 1917. The beet leafhopper and the curly leaf disease that it transmits. Utah Agr. Exp. Sta., Bul. 155, pp. 1–56.
2. HARTUNG, W. J., 1919. Enemies of the leafhopper. Natural foes of *Eutettix tenella* in California and their usefulness. Facts About Sugar, vol. 8, no. 24, pp. 470–471; no. 25, pp. 492–493.
3. SEVERIN, H. H. P., 1919. Investigations of the beet leafhopper (*Eutettix tenella* Baker) in California. Jour. Econ. Ent., vol. 12, no. 4, pp. 312–326.
4. SEVERIN, H. H. P., and BASINGER, A. J., 1922. Facts concerning natural breeding area of beet leafhopper (*Eutettix tenella* Baker) in San Joaquin Valley of California. Jour. Econ. Ent., vol. 15, no. 6, pp. 411–419.
5. SEVERIN, H. H. P., 1923. Investigations of beet leafhopper (*Eutettix tenella* Baker) in Salinas Valley of California. Jour. Econ. Ent., vol. 16, no. 6, pp. 479–485.
6. SEVERIN, H. H. P., 1924. Natural enemies of beet leafhopper (*Eutettix tenella* Baker). Jour. Econ. Ent., vol. 17, no. 3, pp. 369–377.

INJURIES TO PEPPERS IN CALIFORNIA BY *ANTHONOMUS EUGENII* CANO

By ROY E. CAMPBELL, *Associate Entomologist, U. S. Bureau of Entomology, Alhambra, California*

ABSTRACT

During 1923 the pepper weevil (*Anthonomus eugenii*) was found to be present in several pepper fields in Southern California. The insect was most abundant during November and December and practically all of the late peppers in the infested fields were destroyed. Injury to the pods resulted in decay which usually started in the seed cluster and in small peppers the growth was checked and the pods distorted.

On November 23, 1923, the writer's attention was called to the condition of a 5-acre field of Chinese Giant bell peppers about 2 miles north of La Habra, in the southern part of Los Angeles County, Calif. The grower stated that an insect was damaging the peppers to such an extent that he would not even recover the cost of the seed from the planting. The pods set profusely, but became misshapen, turned red prematurely, failed to mature, and many dropped from the plant. On examination they proved to be infested with small larvae. Some pods were collected, from which a few days later small beetles emerged. These were identified by Dr. F. H. Chittenden as *Anthonomus eugenii* Cano, the pepper weevil.[1] This is the first record of the occurrence of this insect in California. It was previously recorded from Texas,

[1]This species is treated under the name of *Anthonomus aeneotinctus* Champion in Bulletins 54 and 63, Bureau of Entomology, U. S. Department of Agriculture.

where the crop of bell and tabasco peppers was seriously injured in 1903, 1904, and 1905.[2]

On November 30, 1923, other fields about 4 miles distant were examined. They totaled 30 acres, but included three separate plantings, two in the bottom of small valleys and the third on a hilltop 150 feet higher and at a distance of one-half mile. One field was in peppers for the first time, while the others had been planted to peppers for several years. Aside from these three fields, no other peppers had been grown within 5 miles during the preceding five years. All three fields had produced large crops; an average of nearly 400 crates (40 pounds each) to the acre in the best field had already been picked, and there were indications that the entire acreage would average this amount. Careful examination showed a high percentage of infested peppers. Those practically matured were not visibly damaged to an extent that would render them unmarketable, but nearly all immature peppers were so badly infested that it was doubtful if they would develop. This later proved to be the case, for after the remaining mature peppers were picked, only a few more crates were taken from the fields. Although the bulk of the crop had been picked the loss was heavy, because it is the late peppers which bring the high price. The loss caused by the insect in the La Habra district was estimated at from $12,000 to $15,000. The growers in this locality stated that they had observed similar damage in previous years, but that it was so insignificant that no investigations of its cause were made.

The horticultural commissioner of Orange County observed infestation in peppers about December 1, 1923, in Bell Canyon, Orange County about 30 miles southeast from the La Habra infestation. The owner reported that he had grown a few peppers for home consumption for several years but that the nearest fields of peppers grown on a commercial scale were at least 30 miles distant. The peppers were badly infested and on advice of the commissioner they were pulled and burned.

Several pepper fields in the San Fernando Valley were inspected on December 11, 1923. These were about 50 miles northwest from the La Habra fields and on a gentle slope some distance from the nearest hills, while the La Habra fields were among low hills. In one field, from which the commercial crop had been removed, 10 per cent of the remaining peppers were infested, but in fields one-half mile to a mile away no weevils were found.

[2] Walker, C. M. Bulletin 54, Bureau of Entomology, U. S. Department of Agriculture.

According to Walker,[2] oviposition occurs in small buds, blossoms and young fruit. Whether or not the females select blossoms or pods of a certain stage could not be determined by the writer, but more immature than mature pods were infested and damaged. Infestation occurred in even the smallest peppers, including those no bigger than the end of one's little finger. When the larger pods become infested, no apparent damage is done, the peppers mature and are still marketable, but an infestation in small pods checks growth and causes them to be deformed and almost invariably unfit for market. The larvae may feed and develop in the pepper wall, but are more often found in the seed cluster. The feeding tunnel is surrounded with brownish frass, and pupation takes place within a cell formed from this material. The brownish masses of frass surrounding the larval tunnels and pupal cells present an unsightly appearance when the pepper is opened. Decay usually begins around these masses, so that the middle of the pepper may have a number of decayed spots, or may be a mass of decay.

Although feeding is light, it is quite apparent that the presence of the insect in the smaller pods causes malformation of the peppers, checks growth, and causes them to turn red prematurely.

On December 4, 1923, an examination of peppers on 25 plants in various parts of the field at La Habra showed that of the immature peppers 73 per cent were infested, while of the mature peppers only 20 per cent were damaged. By December 24, however, an examination showed 100 per cent infestation. The number of insects in these pods is shown in the following table.

TABLE I.—NUMBER PER POD OF DIFFERENT STAGES OF THE PEPPER WEEVIL FOUND IN BELL PEPPERS AT LA HABRA, CALIF., DECEMBER 24, 1923

Larvae	Pupae	Adults	Total Number, all stages
Max. 13	Max. 10	Max. 3	23
Min. 1	Min. 0	Min. 0	1
Ave. 3.6	Ave. 1.6	Ave. .45	5.75

On January 7, 1924, an examination of old peppers still on the plants at La Habra showed, for 10 pods taken at random, a total of 11 adults, 2 pupae, and 1 larva, while by January 12, living adults were found in many pods, but only a few pupae and no larvae. By this time plant growth had entirely stopped, and all peppers were red and small.

ADIRUS TRIMACULATUS SAY—A ROSE PEST

By A. B. CHAMPLAIN, *Pennsylanvia Bureau of Plant Industry*

ABSTRACT

Adirus trimaculatus (Say), a sawfly of the family Cephidae, known as a borer in blackberry canes in the larval stage, is definitely identified as the borer doing similar damage in rose stems.

It is suggested that infested portions of plants be removed and destroyed. Extensive control measures have not been attempted, and there is room for considerable investigational work both of a biological and economic nature.

Larvae of *Adirus trimaculatus* (Say) are known to be borers in blackberry canes and in a number of instances have been suspected of being a rose pest. At times during the past five years, correspondents of the Pennsylvania Bureau of Plant Industry have submitted samples of rose twigs and shoots that were injured by borers in the form of whitish larvae that tunnel the stems and kill the terminals, with the request for identification and remedies.

In addition to our own provisional identification of this insect as *Adirus trimaculatus*, some of the material was sent to Mr. S. A. Rohwer, Specialist in Hymenoptera, at the United States National Museum, who replied as follows: "We have received similar larvae from rose on a number of occasions, but so far the adult has never been reared and the identification is based entirely on the larva, but is supplemented by the fact that we do not know any large Cephid other than Adirus which could be associated with it."

Mr. William Middleton[1] writes concerning the larva: "This species is recorded boring in blackberry, while the specimens described was received through Dr. F. H. Chittenden's office as coming from rose."

Dr. E. P. Felt[2] mentions that larva as follows: "The reception of a horn tail larva, possibly that of *Adirus trimaculatus* (Say), breeding in rose shoots at Woodhaven, was unusual and may mean the introduction of a new rose pest."

The late John B. Smith, in "The Insects of New Jersey," records this species and comments: "The larva bores in the stems of blackberry canes entering at the bottom and eating out the center to the top." This is just the reverse of what actually happens, the larvae work from the tips down through the center of the canes.

The adults of *Adirus* fly during the latter part of May and through June and July in Pennsylvania and on July 12, 1924 the author was for-

[1]Notes on the larva of some Cephids, Proc. Ent. Soc., Wash. Vol. XIX, P. 177, 1917.

[2]N. Y. Report 32, Page 60, 1918.

tunate in finding females ovipositing on the tender new rose shoots. These females were first observed flying around the rose bushes in the yard, alighting from time to time on the terminals of the new shoots that had made their growth during the season. Always head downward, they moved in that direction, using the tip of the abdomen and sometimes the ovipositor as a tactile organ, inserting the latter at short intervals into the soft tender growth. But a second was required to insert an egg which was placed in the pith at right angles to the outer bark.

Considerable damage is done by the females in puncturing the buds and terminals, several dozen punctures were observed along a distance of a few inches, although it is very likely that but few contained eggs.

After hatching from the egg, the larva that gets the first start is apparently the only one that makes good in a single terminal, no instance of more than one in any completed tunnel was observed. Beginning with the terminal, which wilts and dies, the larva feeds on the pith, packing the excrement behind it as it travels through the stem, sometimes for considerable distances, varying with the length of the shoots and the time when the egg was deposited in relation to the season.

At certain intervals the larva makes a girdle on the inside of the stem above where it is feeding and working and frequently the stem breaks at this point. When full grown the larva makes an opening partially through the stem to the outside, and spins a cocoon and overwinters in the space that it last occupied when feeding. Pupation probably takes place in the spring and our first records of adults are on May 21.

Records in the collection of the Bureau of Plant Industry show that adult specimens were taken:

Dauphin County, Pa.,—May 21, J. N. Knull;
" " " —June 1, A. B. Champlain;
" " " —June 30, H. B. Kirk;
" " " —July 4, J. G. Sanders;
" " " —July 12, A. B. Champlain.

Records in the files show that larvae were found in stems during June and July. At Harrisburg, Pa., June 15th, Mr. P. T. Barnes found larvae about one-half grown boring in the new growth of American Pillar roses. Letters from correspondents refer to finding larvae in stems during July. On July 12 at Harrisburg where the observations on the oviposition of of this species were made, several stems contained small larvae.

Cutting off the infested tips as soon as injury or wilting is noticed and before the larvae work very far down the stem, would be about the surest

and simplest remedy. After the larvae work down the stems it will be more difficult to locate them, the stems may look green and healthy but the borings or frass in the center of the stem will show that the larvae have not been reached. Cut below this area and burn cuttings.

THE PREPARATION FROM TOBACCO OF A SOLUTION FOR SPRAYING[1]

By O. M. Shedd and A. J. Olney, *Kentucky Agricultural Experiment Station*

Abstract

The only grade of Kentucky tobacco, other than stems and stalks, which can be used profitably at present prices for making a spray solution is common trash. This is chiefly composed of diseased and damaged leaf. It has a widely variable and generally low nicotine content but usually contains more than stems and stalks of the same variety. The range for 79 samples of white Burley and dark tobacco was from 0.26 to 4.50 per cent nicotine in the air-dry trash.

Angular leaf-spot and wildfire lower the nicotine content but not the nitrogen content of the leaf. The nicotine content of the leaf which cured with a green color was not affected to the same extent as that of diseased leaf.

Infusions made from 26 samples of trash, using such quantities of cold water as would give .05 to .07 per cent of nicotine in the solution, as computed from analyses of the samples, were about equally effective in exterminating aphis. Lower concentrations were not as satisfactory.

Black Leaf 40 solution diluted to contain 3.5 per cent of nicotine did not injure tomato plants. Higher concentrations caused injury which was partly preventable by soap.

It is important that the approximate nicotine content of trash used to make a spray solution should be known. If it is not, then a low percentage of nicotine must be assumed. This probably should be about 1 per cent for white Burley and 1.7 per cent for dark trash grown in Kentucky.

The object of this paper is to emphasize the importance of having some knowledge concerning the nicotine content of tobacco which is to be used for the home preparation of a spray solution. This should be given first consideration and if it is disregarded, unsatisfactory results will frequently be obtained and this may create prejudice against all such preparations, including commercial nicotine solutions which undoubtedly have demonstrated their merit.

Nicotine is the characteristic alkaloid of tobacco and is a very powerful poison, particularly for certain insects. A solution of it has the peculiar advantage that a moderately excessive amount does not injure

[1]Approved by the Director of the Kentucky Agricultural Experiment Station, and read at the symposium on insecticides and fungicides of the American Chemical Society at their meeting in Washington, D. C., April 21–25, 1924.

tender plants. It is used more than any other insecticide to destroy aphis or plant lice. Various concentrated extracts of tobacco are now on the market and with proper dilution they can be used with unvarying success provided their guaranteed content of nicotine is present. Furthermore, they can usually be added to certain other insecticides without detriment to either.

The question frequently arises whether diseased, damaged or waste tobacco that cannot be profitably sold may be used for the preparation of a spray solution. The answer would be that it can, provided its approximate nicotine content is known. The nicotine content of tobacco varies greatly depending on many factors such as variety, fertility and character of soil, climate, season, curing, blight or disease and other possible causes.

Tobacco stalks contain less nicotine than the stems and the latter less than the leaf. The leaves nearest to the ground contain less nicotine than the upper ones. With respect to the Burley plant, the lower leaves are lighter in color and go into the smoker grades while the middle and most of the upper ones are included in the red filler grades and wrappers. It so happens that at present prices, the only kinds of tobacco which probably can be profitably used for sprays comprise stalks, stems and common trash. The last consists chiefly of sweepings, refuse, and diseased and damaged leaf and usually contains relatively the smallest nicotine content of any grade. It usually has more nicotine, however than stalks or stems and is to be preferred when it can be obtained at a low cost. It seems that the factors which vitiate the quality of the leaf also materially reduce its nicotine content, with the possible exception when matured leaf cures with a green color in the barn. It is thought by some growers that this is caused by exposure to chilly winds in the curing. This color materially reduces the value but will often disappear after the tobacco is bulked for a short time and put thru the dryer. The nicotine content of tobacco with this green color does not appear to be affected to the same extent as that of tobacco which is house burned or diseased. For illustration, two samples of this green tobacco were found to contain 1.96 and 2.38 per cent of nicotine in the air-dried leaf, whereas diseased tobacco was found to contain much less, as will be shown later.

The Burley crop of 1920 was probably one of the most inferior ever produced in central Kentucky, due to the prevalance of two diseases now commonly known as wildfire and angular leaf-spot. These diseases were, also, present during the same year in the dark tobacco region of

this state but to a more limited extent. The senior author had occasion at that time to collect a large number of samples of diseased Burley tobacco. This sold on the market at from fifty cents to two dollars per hundred pounds and these prices did not cover the stripping and warehouse charges. The question was often raised then what disposition other than as a fertilizer could be made of this class of tobacco if left on the farm and if any part could be used for making a spray. To arrive at more definite knowledge concerning the latter point the senior author made the chemical investigations described herein and the results obtained suggested the cooperative spray experiments which were later undertaken to corroborate the chemical findings.

Twenty-six samples were selected for the work, eighteen of air-cured Burley and eight of dark tobacco. Six of the latter were fire-cured and the remainder were air-cured. The midrib or stem had been previously removed from three of the Burley and from all of the samples of dark tobacco, in connection with some other work. The dark tobacco was freer from disease and in most instances had a market value that would probably not permit its use in making sprays. Diseased samples of this tobacco could not be obtained at the time. All the Burley samples, however, were more or less infected with wildfire and angular leaf-spot. Nicotine determinations were made on the air-dried samples with the following results:

TABLE 1—PERCENTAGE OF NICOTINE IN AIR-DRIED COMMON TOBACCO TRASH USED IN SPRAYING EXPERIMENTS.

	Maximum	Minimum	Average
Burley, 18 samples	2.93	0.26	1.07
Dark (fire-cured) 6 samples	4.30	0.98	2.57
Dark (air-cured) 2 samples	4.48	2.16	3.32

The sample of Burley containing only 0.26 per cent of nicotine in Table 1 may be exceptional. The next higher percentage of nicotine found was 0.68 per cent, making the range in 17 samples from 0.68 to 2.93 per cent, and the average 1.12 per cent. The nicotine content of a majority of the samples was close to this average.

To a convenient weight of each of the above powdered samples, the required volume of cold tap water was added so that the resulting solution would contain .07 per cent of nicotine, assuming that a complete extraction of it would be obtained. The samples were allowed to remain in the cold water for 24 hours and the solution, after decantation, was used as a spray. It is doubtful if all the nicotine was extracted but if seventy per cent or more was obtained, which is probable, the solution

would have contained about .05 per cent. The strength generally recommended is from .05 to .07 per cent.

The solutions were applied to aphis on tomatoes in the greenhouse and on plum trees in the open. The results were about the same with all samples. All small or medium sized aphis were killed in 2 hours and practically all the remaining or large ones after 24 hours. The number under observation in the individual experiments generally was two to five hundred and it was noticeable that the few which survived after 24 hours' observation were all full-grown. The medium sized and small ones were always killed. The highest percentage surviving was 3 per cent, in only one case, but generally only about 1 per cent, by actual count, survived after 24 hours.

The foregoing results were obtained with freshly prepared solution. One of these solutions which, when fresh, had killed all the aphis, was tried again after standing for nearly a week; it was found to exterminate only 82 per cent of the aphis. In the meantime, however, the decoction had commenced to ferment and had developed a disagreeable odor. This indicates that the fresh solution should be used or some preservative added.

One tobacco was tried on aphis by taking the fresh solution which was found to exterminate all and diluting it with 1, 2, 4 and 8 parts of water. The degrees of extermination after 24 hours' observation were 76, 79, 30 and 11 per cent, respectively. The aphis in the experiment which gave 79 per cent extermination were smaller than the others, which accounts for a larger number killed in this case. In all cases, the surviving aphis were of the larger size. It appears from these particular experiments that the solution should contain at least .05 per cent of nicotine for effective results; in fact, it might be preferable for it to have about .10 per cent to get rid of all mature aphis in a few hours where it was to be applied in the open with a probability of rain washing it off before all were killed.

The results clearly demonstrate that if recommendations are to be made for preparing sprays from tobacco the nicotine content of which is not known, a very low percentage would have to be taken as a standard for any particular variety, otherwise unsatisfactory results would frequently be obtained. On the other hand, by accepting such a low standard, some solutions would necessarily carry very much larger amounts of the alkaloid than is desired, due to its higher percentage in the samples from which they were prepared.

In order to determine if a reasonable excess of nicotine would affect tender plants, different concentrations of Black Leaf 40 were used on tomato plants in the greenhouse. It was found that the plants were not injured after an interval of 2 days by a solution containing approximately 3.5 per cent nicotine or about 50 times the concentration generally recommended. Solutions stronger than 3.5 per cent apparently injured the plants and the injury was more noticeable as the concentration was increased.

Inasmuch as soap is commonly used in nicotine sprays, another set of experiments was made in which soap was added to the solution. This was found to partly prevent injury.

It will be of interest for comparison to give the amounts of nicotine which were found in a much larger number of samples of common trash, especially of Burley, than were used in the spraying experiments. The samples used in that work, however, are included in the table. They were taken from the 1920 and 1921 crops but the latter crop of Burley was freer from disease, and a large number of the samples selected from it included mixed common filler and smoker grades which had a market value that would not permit their use for sprays. They would ordinarily be considered as common trash, however. As they had been used in connection with other work, the stem had been removed from all except 15 samples of the Burley.

TABLE 2—PERCENTAGE OF NICOTINE IN AIR-DRIED COMMON TRASH OF 1920 AND 1921 CROPS.

	Maximum	Minimum	Average
Burley, 63 samples	4.00	0.26	1.75
Dark (fire-cured) 10 samples	4.50	0.98	3.06
Dark (air-cured) 6 samples	4.48	2.16	3.22

The Burley sample containing 0.26 per cent nicotine may be exceptional. If this is omitted, the range for 62 samples is from 0.67 to 4.00 per cent, and the average 1.77 per cent.

In order to illustrate the effect of disease on the nicotine and total nitrogen content of tobacco, two lots of Burley were selected. One lot consisting of 5 hands was appreciably infected and the other of 10 hands was very badly infected with wildfire. Representative samples of leaf with the stem present were taken from each hand of the two lots and individual nicotine and total nitrogen determinations were made. The remainder of each lot then had the stem removed and composite samples of each were used for analysis. The results follow:

TABLE 3—PERCENTAGE OF NICOTINE AND TOTAL NITROGEN IN AIR-DRIED COMMON TRASH, INFECTED WITH WILDFIRE.

	Appreciably infected			Badly infected		
	Max.	Min.	Ave.	Max.	Min.	Ave.
Leaf including stems. Nicotine	2.93	0.68	1.32	1.27	0.69	0.94
Total nitrogen	4.35	2.23	2.96	4.20	2.56	3.46
Composite of samples above with stem removed. Nicotine			1.84			1.21
Total nitrogen			3.37			3.98

It will be observed in Table 3 that the badly infected tobacco has less nicotine but more nitrogen than the other and that the removal of the stem increases the average amounts of these constituents in both kinds of tobacco.

It was impossible to obtain for the spray work a sufficient number of samples of diseased dark tobacco, therefore those that were used represent a better quality than would be employed for this purpose.

If general recommendations were to be made based on the results reported here together with a large number of nicotine determinations on other grades of both kinds of Kentucky tobacco, it would probably be safe to assume that such Burley as might be used for spray solutions would contain about 1 per cent, and dark tobacco about 1.70 per cent of nicotine.

Any sample which is to be used for the preparation of a spray solution should be rendered as fine as possible so as to permit a more thoro extraction. In no case, however, will a complete solution of the nicotine probably be obtained under practical working conditions. Of course the judgment of the user would prevail as to whether any lot of tobacco could more profitably be used in a spray solution but in arriving at a decision it must be remembered that a considerable proportion of the fertilizing ingredients still remains in the residue after the extraction of the nicotine and this may be used as a fertilizer.

SUMMARY

The only grade of Kentucky tobacco, other than stems and stalks, which can be used profitably at present prices for making a spray solution is common trash. This is chiefly composed of diseased and damaged leaf. It has a widely variable and generally low nicotine content but usually contains more than stems and stalks of the same variety. The range for 79 samples of white Burley and dark tobacco analyzed is from 0.26 to 4.50 per cent.

Angular leaf-spot and wildfire lower the nicotine content but not the nitrogen content of the leaf. The nicotine content of the leaf which

cured with a green color is not affected to the same extent as that of diseased leaf.

Infusions made from 26 samples of trash, using such quantities of cold water as would give .05 to .07 per cent of nicotine in the solution, as computed from analyses of the samples, were about equally effective in exterminating aphis. Lower concentrations were not as satisfactory.

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It is important that the approximate nicotine content of trash used to make a spray solution should be known. If it is not, then a low percentage of nicotine must be assumed. This probably should be about 1 per cent for Burley and 1.7 per cent for dark trash grown in Kentucky.

LEAD ARSENATE, LIME-SULFUR, AND TOBACCO DUST AS A TRIPLE SPRAY MIXTURE

By LEON R. STREETER, *Geneva, N. Y.*

The possibility of using tobacco dust as a source of nicotine in lime-sulfur-lead-arsenate sprays is being investigated at the New York State Agricultural Experiment Station.

It seemed advisable to determine the amount of nicotine dissolved from fine ground tobacco dust by lime-sulfur.

The tobacco dust contained 1.2 % of nicotine. In making the spray mixture in quantities for field work 200 lbs. of tobacco was added to 100 gals. of concentrated lime-sulfur. The mass was stirred thoroly to insure intimate mixture. The following day the mixture was again stirred and a sample taken for nicotine analysis. In experiment Nos. 1 and 2 the tobacco dust was added to hot lime-sulfur. In experiment No. 3 the lime-sulfur was allowed to cool before adding the tobacco dust. The results of these experiments are given in Table No. 1.

TABLE 1.—SHOWING THE SOLUBILITY OF NICOTINE IN LIME-SULFUR

Experiment number	Tobacco dust	Lime-sulfur	Time of soaking	Nicotine soluble
	lbs.	gals.	hrs.	%
1	200	100	18	82
2	200	100	24	94
3	200	100	24	86

Some additional experiments were performed in the laboratory, using convenient volumes, to compare the solvent action of water with that of lime-sulfur, also to determine the amount of nicotine recovered in the filtrate when separated from the sludge. In the following experiments a tobacco dust containing 3.6 % nicotine was used. The results of these experiments are given in Table No. 2.

TABLE 2.—SHOWING THE RECOVERY OF NICOTINE IN WATER AND LIME-SULFUR FILTRATES

Experiment number	Solvent	Agitation	Time of soaking	Filtrate recovered	Nicotine recovered
		Hourly			
		hrs.	hrs.	%	%
4	Cold H_2O	6	24	76.9	71.9
5	Hot "	6	24	76.9	70.6
6	Cold "	6	48	73.6	87.1
7	Cold—S	6	24	75.5	77.6

Ramsay and Griffiths[1] report a recovery of 63 % to 72.7 % nicotine soluble in water. The fact that these writers used a dust containing less than 1 % of nicotine may account for the somewhat lower nicotine yield reported by them. The same experimenters also state that the addition of lime does not appreciably increase the quantity of nicotine soluble in water, but state that a clearer solution can be obtained when lime is added, due to precipitation of much of the organic matter by the calcium. Experiments carried on in this laboratory agree with this statement, as shown by the results in Table No. 3.

TABLE 3—SHOWING THE EFFECT OF ADDING CALCIUM HYDRATE

Experiment number	Solvent	Soluble nicotine
		%
8	Cold H_2O	92.1
9	Cold H_2O	92.09
	2 lbs. $Ca(OH)_2$	

Study of these data will show that there is but little difference in the solvent action of water and lime-sulfur and that heating the solvent does not increase the quantity of nicotine found in solution. It is likewise evident that the addition of an alkaline substance such as hydrated lime does not increase the solvent power of water.

[1]Ramsay, A. A., and Griffiths, E. L. The Preparation of Home-Made Tobacco Wash. Agr. Gazette of New South Wales. Vol. 35, Part 4. 1924.

When tobacco dust is added to lime-sulfur some hydrogen-sulfide may be liberated. This difficulty can be partially overcome by the addition of a few pounds of hydrated lime per 100 gallons of spray mixture. No test for H_2S was obtained when the filtrate from experiment No. 9 was added to lime-sulfur solution.

From a theoretical standpoint nicotine should be readily volatilized from alkaline lime-sulfur solution. A few preliminary experiments on the volatility of nicotine from this mixed spray have been made. These experiments indicate that the rate of volatility is about the same as that from other preparations of the same nicotine content.

The chemical compatability of this triple spray is discussed in Bulletin No. 521 of this station.[2]

THE EFFECTS OF OIL SPRAY ON APPLE APHIDS

By K. C. Sullivan and O. C. McBride

In certain sections of the Mississippi Valley the lubricating oil emulsions have been used as a dormant spray for the control of San Jose Scale with a certain degree of success. The question has been raised as to the effect of these emulsions on apple aphids. The common practice is to apply a separate spray of nicotine sulphate just as soon as the aphids hatch. This extra spray costs considerable in both time and material. Some growers however, have added the nicotine sulphate to the first summer spray of lime sulphur and arsenate of lead. This has been fairly satisfactory but is just a little late for the most effective results.

The lubricating oil emulsions have been used extensively at the Missouri Agricultural Experiment Station during the past two years in order to determine their value as a dormant spray and also as a summer spray on apple trees. During the course of this work extensive observations were made as to the efficiency of these sprays in controlling apple aphids.

The aphis which has caused the most trouble in Missouri on apples during the past two years is the common grain aphis (*Siphocoryne avenae* Fab.) This aphis migrates to the apple in the fall from the grain and deposits eggs on the small twigs and buds. At the time the buds begin to push out in the spring the eggs hatch. From three to four generations are reared on the apple before they migrate back to the grain. They are often present in large numbers and cause considerable damage to the young tender growth.

[2]Thatcher, R. W., and Streeter, Leon R. Chemical Studies of the Combined Lead Arsenate and Lime-Sulfur Spray. N. Y. S. Agr. Exp. Sta. Bul. No. 521. 1924.

The following varieties of apples were sprayed and counts made to determine aphid control: Rome Beauty, Delicious, Jonathan, Winesap, Ben Davis, Grimes Golden, Black Ben Davis, Liveland Raspberry, Stayman Winesap, Paragon, Early Harvest, McIntosh, Ben Hur, King David, Ingram, Ginnie and Bauer Sweet.

EXPERIMENTS 1923

Treatment	Date sprayed	Date Counted	No. buds	Aphids Alive	Ave. per bud
1.—Lime Sulfur 1–7	4/9/23	4/12/23	110	319	2.8
2.—Soap Oil Emulsion 2%	4/9/23	4/13/23	64	271	4.23
3.—Soap Oil Emulsion 1% with $CuSo_4$	4/10/23	4/16/23	102	319	3.12
4.—Soap Oil Emulsion 2% with $CuSo_4$	4/10/23	4/16/23	113	93	.823
5.—Kayso Oil Emulsion	4/10/23	4/13/23	38	32	.842
6.—Lime Sulfur 1–7	4/11/23	4/17/23	33	12	.363
7.—Soap Oil Emulsion 2%	4/11/23	4/12/23	57	285	4.52
8.—Check		4/14/23	33	164	4.97
9.—Check		4/17/23	16	95	5.93
10.—Check		4/18/23	82	575	7.01

EXPERIMENTS 1924

Treatment	Date Sprayed	Date Counted	No. Buds	Aphids Alive	Ave. per bud
1.—10% Kayso Oil Emulsion Dormant	2/22/24	4/25/24	150	194	1.29
2.—Lime Sulfur 1–7	4/11/24	4/12/24	152	43	.282
3.—10% Kayso Oil Emulsion Delayed Dormant	4/12/24	4/25/24	124	43	.346
4.—10% Kayso Oil Emulsion Delayed Dormant	4/12/24	4/25/24	150	51	.34
5.—2% Kayso Oil Emulsion	4/14/24	4/25/24	150	546	3.64
6.—2% Kayso Oil Emulsion	4/14/24	4/15/24	51	8	.15
7.—4% Kayso Oil Emulsion	4/14/24	4/25/24	100	346	3.46
8.—Lime Sulfur 1–7	4/14/24	4/25/24	100	901	9.01
9.—1% Kayso in Lime Sulfur	4/21/24	4/25/24	100	48	.48
10.—Kayso Oil Emulsion 2% with 3–4–50 Bord.	4/21/24	4/25/24	450	879	1.95
11.—Check		4/15/24	292	198	.678
12.—Check		4/25/24	450	1659	3.46

The preceeding tables show the kind of sprays used, date spray was applied, date counts were made, number of buds counted, number of aphids alive and the average number of live aphids on each bud.

It will be noted that in no case did any of the spray materials used give effective control as compared to the checks. With one exception,

the 10 % Kayso Oil Emulsion applied as a dormant spray, all sprays were applied after the eggs had hatched and as the data shows some of the emulsions as well as the lime sulfur gave partial control but not enough to warrant recommending them. For the regular dormant spray for San Jose Scale a 2% emulsion is usually recommended. In this work it will be noted that a 10% oil emulsion was tried and still not enough control was obtained to recommend its use. From the results obtained it seems evident that lime sulfur or lubricating oil emulsions cannot be recommended for complete control of apple aphids.

ANOTHER LEAD BORING BEETLE

By W. J. CHAMBERLIN, *Forest Entomologist, Oregon State College*

A rather remarkable specimen of insect injury has been submitted to the writer by the Portland Railway Light and Power Company. Owing

FIG. 19.—Work of *Callidium?* in cedar and lead. A portion of the tunnel in the wood and the exit hole thru almost 3/16 of an inch of lead can be seen. The granulated material stored in the mine is lead borings.

to interference of current a portion of underground cable was removed and found to have been punctured by insects. The cable covering was

of creosoted cedar and lead plate, the latter 3.5 mm. in thickness. The larvae, evidently a *Callidium*, had matured in the cedar and worked out thru the lead, storing the lead borings in the mine behind it just as if they were wood borings. The two emergence holes in the lead plate measure 4 by 10 mm. and 4 by 5 mm. This latter looks as tho the insect may have failed to get thru. The hole is 9 by 6 mm. on the inside and 4 by 5 mm. on the outside. The lead borings resemble pellets more than shavings, they range in size from one to four-tenths of a millimeter in diameter, many distinctly show the marks of the mandibles.

Another case of a beetle, evidently a Buprestid, penetrating lead was brought to my attention, some two years ago, at Portland, Oregon. In this case the insect emerging from a pole encountered a lead covered cable running down the pole to pass under a railroad. The lead sheath was one-quarter inch thick and the beetle gnawed a groove in the side of it one-quarter inch wide and about three-sixteenths inch deep, this enabled it to escape—at the same time the hole did not penetrate entirely thru the cable.

TREE CRICKET INJURY TO PRUNES

By M. A. YOTHERS, *Yakima, Washington*

The Tree Crickets, *Œcanthus spp.*, are generally known as beneficial insects since they feed very largely upon plant lice. In a minor way they are sometimes recognized as of economic importance on account of the injury their oviposition punctures cause to raspberry canes and fruit tree twigs. During the past several years, however, and especially the past two seasons these crickets have become one of the most important insect pests in the extensive prune orchards of southern Idaho, causing an annual loss of hundreds of thousands of dollars.

When the crickets (one species of which is *Œcanthus niveus* De Geer) become about two-thirds grown or reach their fourth or fifth instars, they begin feeding upon the half-grown prunes, gnawing holes about over the surface and often deep down into the fruit (Plate 13). This injury starts about the first of August and continues until the prunes are harvested or about the last half of September. Before the prunes are harvested the crickets have reached maturity and continue their feeding with even greater avidity than before.

It often happens that the per cent of tree cricket-injured fruit is so great that it does not pay to harvest, sort and pack the crop. When the per cent of injury is above 50% it is usually considered too expensive to sort and handle it. Not only is the injured fruit rendered unsightly and below the requirements for packing regulations, but it soon starts to

decay after being packed, especially in cold storage, and soon breaks down, becoming slimy and extremely disagreeable. This slime of the mouldy prunes spreads to adjoining prunes and then throughout the whole package, rendering the entire box unmarketable and unfit for use. This condition usually occurs in storage at the point to which the fruit has been shipped after the grower has been to the expense of paying freight or express charges.

Some idea of the number of these tree crickets can be gained when it is pointed out that Mr. Claude Wakeland, Entomologist of the University of Idaho, has counted as high as 1386 individuals killed under a single tree.

APPLICATION OF THE RONTGEN TUBE TO DETECTION OF BORING INSECTS

By N. YAGHI, *Special Entomologist in the Government Agricultural Experiment Station, Nishigahara, Tokyo, Japan*

The röntgen tube has ever been used in experiments on the effect of the rays on development of insects and sterilization of gonads. I used

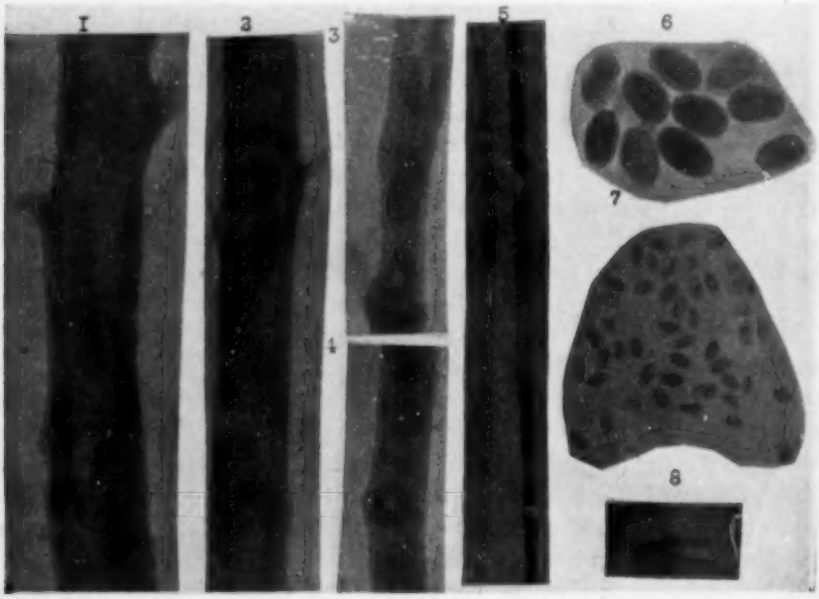
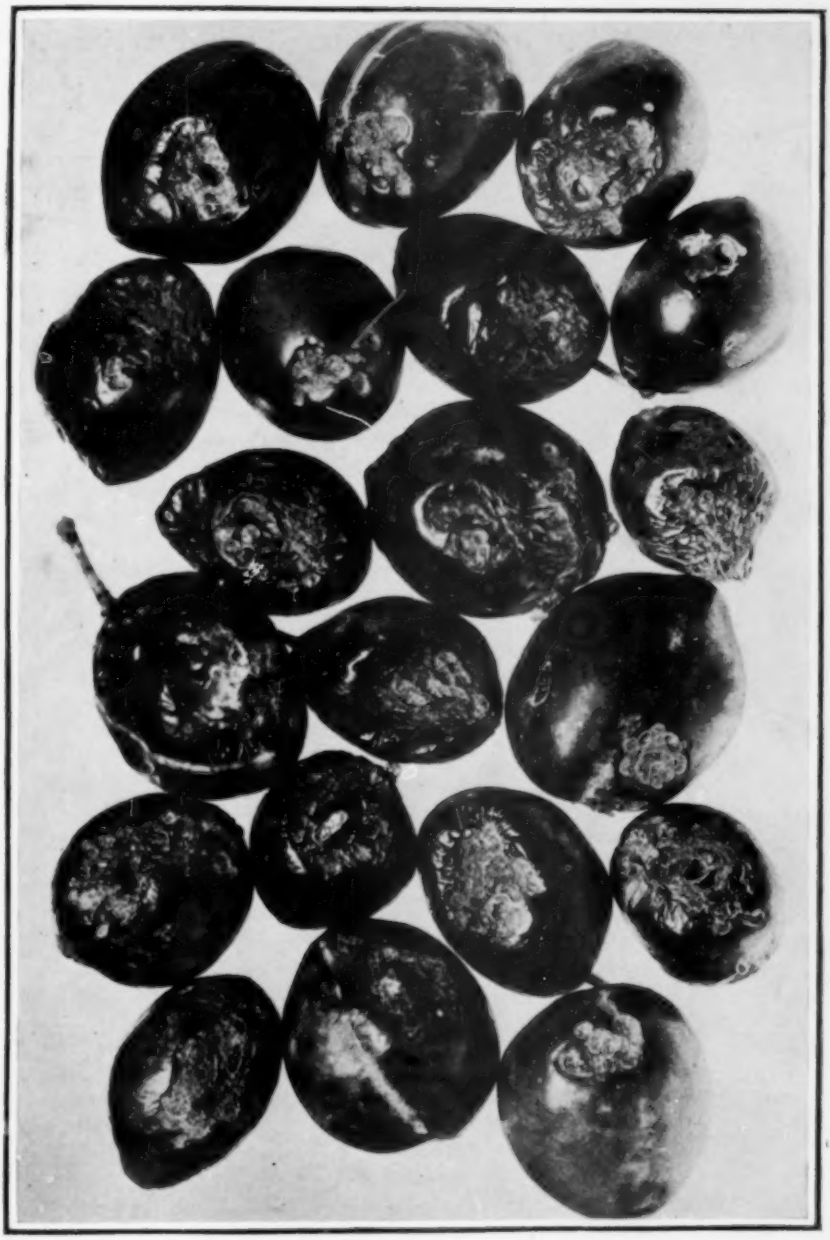


FIG. 20.—1, *Apriona rugicollis* Chev. in apple tree; 2, *Melanauster chinensis* Först. in apple tree; 3, *Chreonoma fortunei* Thom. in pear stem; 4, *Sciapteron regale* Butl. in grape tree; 5, *Chilo simplex* Butl. in rice straw; 6, Bean grains bored by *Pyralis farinalis* L.; 7, Larvae and pupae of *Calandra oryzae* L. in rice grains; 8, *Tinea pellionella* L. in wool matter.



Tree Cricket Injury to Prunes (Original)

the tube as in medical diagnostics to detect boring insects in their food substances and got successful results with the following species of larvae: *Apriona rugicollis* Chev. in mulberry tree, *Batocera lineolata* Chev. in chestnut tree, *Melanauster chinensis* Först. in apple tree, *Sciapteron regale* Butl. in grape tree, *Pyralis farinalis* L. in bean grain, *Tinea pellionella* L. in wool, *Calandra oryzae* L. in rice grain, *Chilo simplex* Butl. in rice straw and *Ptinus fur* L. in blankets. Under laboratory conditions tests on woody plants made with a coolidge tube permitting a medium high energy input in voltage 84000, amperage 4.3 m. a. and hardness 6.3° , or a less intense ray on rice straw and wool. I suggest the röntgen tube may be a very useful apparatus for studying the life of boring or parasitic insects.

Ethyl Acetate—Carbon Tetrachloride Mixture. On April 7, 1922, the General Managers' Association of Chicago (representing the leading railway systems in the United States) prohibited, because of the fire hazard involved, the use of carbon disulphid and a mixture of carbon disulphid and carbon tetrachloride for fumigating railway cars except at points at New Orleans and Baltimore. As a result of a resolution adopted at the same time and presented to the Secretary of Agriculture, an agreement was drawn July 17, 1922, by the Bureaus of Chemistry and Entomology which has resulted in a study of the toxicity of over one hundred organic compounds and various combinations of these upon *Sitophilus oryza* and *Tribolium confusum*. A technical bulletin, "Fumigation Against Grain Weevils with Various Volatile Organic Compounds," has been prepared by the Bureaus giving the results of the work from July, 1922, to the spring of 1924. This work and that of the summer of 1924 indicates that a mixture of four volumes of ethyl acetate and six volumes of carbon tetrachloride gives an effective non-inflammable and non-explosive fumigant against adult weevils in wheat in grain cars. These two fumigants must be tested for freedom from odoriferous constituents of low volatility or undesirable odors will be retained by the wheat, flour, and the finished loaf of bread. The ethyl acetate should be at least 99 per cent pure. Since the vapor pressure of ethyl acetate and carbon tetrachloride is almost the same, a mixture of the two vaporizes practically as if it were a single compound.

At present forty pounds of the mixture is recommended for each thousand cubic feet of space. The mixture can be had at about ten cents per pound. Since the average capacity of a box car is 2,750 cubic feet and contains on an average about 1,300 bushels of wheat, the cost of fumigating amounts to about 85 cents per 100 bushels. At present the average discount of weevily wheat is about 2 cents per bushel. This charge is prorated as follows: ½ cent for fumigation with carbon disulphid, 1/8 cent for blowing and screening, 1-3/8 cents for dockage. Since the ethyl acetate-carbon tetrachloride mixture costs about 1 cent per bushel, the new fumigant will add to the cost of fumigation, but the extra cost will be offset by the freedom from fire hazard.

Further work must be done outside of grain car fumigation to determine the place this fumigant will take in practical control work.

E. A. Back and R. T. Cotton, *Stored Product Insect Investigations, Bureau of Entomology*

AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

(Organized 1899, Incorporated December 29, 1913)

CONSTITUTION

ARTICLE I

Name and Objects

SECTION 1. This association shall be known as the American Association of Economic Entomologists.

SECTION 2. Its object shall be: (1) To discuss new discoveries, to exchange experiences, and to carefully consider the best methods of work in economic entomology; (2) to give opportunity to individual workers of announcing proposed investigations so as to bring out suggestions and avoid unnecessary duplication of work; (3) to suggest when possible, certain lines of investigation upon subjects of general interest; (4) to promote the study and advance the science of entomology; (5) to publish the Journal of Economic Entomology.

ARTICLE II

Membership

SECTION 1. All economic entomologists, horticultural or apiary inspectors, employed by the General or State governments or by the State experiment stations, or by any agricultural or horticultural association, and all teachers of economic entomology in educational institutions and other persons engaged in practical work in economic entomology, may become members.

SECTION 2. The classes of membership shall be active, associate, and foreign. Active membership shall be conferred only on persons who have been trained in entomological work and whose practical experience or published papers have evidenced their ability to conduct original investigations in economic entomology.

SECTION 3. Associate membership may be conferred on persons who have done general or practical work in entomology and who have by published papers or otherwise, given evidence of their attainments in such work.

SECTION 4. Foreign membership shall be honorary and shall apply only to members residing outside of the United States and Canada.

SECTION 5. Associate and foreign members shall not be entitled to hold office or to vote.

SECTION 6. Membership, other than foreign membership, may be conferred at any regular meeting by a two-thirds vote of the members present upon recommendation of the committee on membership, after a regular application endorsed by two active members has been filed with the Secretary.

SECTION 7. Foreign members may be proposed in writing by any active member and their names shall be acted upon by the committee on membership and the Association, as in the case of other members.

SECTION 8. Any member who shall pay to the Association the sum of $100 may be made a life member and shall thereafter be exempt from dues and shall be furnished with the Journal of Economic Entomology without further charge.

ARTICLE III

Officers

SECTION 1. The officers shall consist of a president, one vice-president, and an additional vice-president for each branch or section, who shall be elected annually, and a secretary who shall be elected for a term of three years, who shall perform the duties customarily incumbent upon their respective offices and as defined in the by-laws. The above officers shall act as an Executive Committee and shall pass on any urgent matters that cannot be deferred until the annual meeting. The president shall not hold office for two consecutive terms.

ARTICLE IV

Annual Meeting—Quorum

SECTION 1. The annual meeting shall be held at such time and place as may be decided upon by the association at the previous annual meeting and special meetings may be called by order of the Executive Committee. Twenty members shall constitute a quorum for the transaction of business.

ARTICLE V

Amendments

SECTION 1. All proposed alterations or amendments to this constitution shall be referred to a committee of three at any regular meeting, and after a report from such committee, may be adopted by a two-thirds vote of the members present; Provided: That a written notice of the proposed amendment has been sent to every active member of the association at least one month prior to the date of action.

BY-LAWS

ARTICLE I

Of Members

SECTION 1. The classes of members are defined in the constitution as are their rights to vote or hold office. Members of all kinds have equal privileges as to presentation of papers and in scientific discussions at the regular meetings, and may, by permission of the presiding officer, speak on business questions before the association.

SECTION 2. All members in good standing have equal rights to the publications of the association or to any publications controlled or distributed by the association.

ARTICLE II

Of Officers and Their Duties

SECTION 1. It shall be the duty of the president, in addition to the ordinary duties of the presiding officer, to prepare an address, to be delivered at the annual meeting over which he presides. He shall also appoint the necessary committees at the first session of the annual meeting.

SECTION 2. It shall be the duty of the secretary to make the necessary arrangements for the meetings of the association and keep a record of the proceedings for publication, to provide the necessary stationery and attend to the general correspondence. He shall collect moneys due, pay all bills incurred by the association, submit a report at each annual meeting, and perform such other duties as may be delegated to him.

SECTION 3. All officers and standing committees unless otherwise provided for shall be elected by ballot after recommendations have been made by a nominating committee.

SECTION 4. The publication of the Journal of Economic Entomology shall be entrusted to an Editor, an Associate Editor and a Business Manager nominated by an Advisory Committee of six members, which latter shall be elected for terms of three years so arranged that two shall be elected annually. The members of this committee shall have an advisory relation to the above constituted Editorial Board.

ARTICLE III

Dues

SECTION 1. The annual dues of members shall be one dollar and fifty cents, which shall be payable in advance. No dues shall be payable from foreign members. Annual dues shall not include subscription to the Journal of Economic Entomology.

ARTICLE IV

Of Meetings

SECTION 1. Notice of the time and place of meetings shall be sent for publication to all American entomological periodicals. The proceedings shall be published as decided by the association.

SECTION 2. Special meetings shall be called as provided for in the constitution, and notice of such meeting shall be given by the Secretary by mailing to each active member a formal notification of the time and place of the meetings at least two weeks before the date fixed in the notice. The notice shall state the reason for such meeting, and shall specify the business to be transacted, and no other business shall be transacted.

SECTION 3. The order of business at regular meetings shall be, at the first session:

1. Calling the meeting to order by the president.
2. Reports of officers.
3. Reports of committees.
4. Appointments of temporary committees.
5. Written business communications.
6. Verbal business communications.
7. New business.
8. Program of papers and discussions.
9. Adjournment.

At the following sessions:

10. Program of papers and discussions.

Business can only be introduced at these sessions by vote of the association.

At the last regular session:

11. Program of papers and discussions.
12. Reports of appointed committees.
13. Miscellaneous business.
14. Election of officers.
15. Fixing time and place of next meeting.
16. Adjournment.

ARTICLE V

Amendments to By-Laws

SECTION 1. Changes in these by-laws may be made by a two-thirds vote at any regular meeting: Provided, notice in writing of the proposed amendment be sent to every active member at least two weeks before the date of the meeting, at which time it can come up for consideration.

Scientific Notes

Fumigating Citrus Trees with Calcium Cyanide Dust. Tests are being conducted in California, Florida, South Africa, Australia and Egypt in fumigating citrus trees with calcium cyanide dust. The methods used are similar to the former method of placing a tent over the tree, but instead of using fumigating jars of liquid hydrocyanic acid gas, calcium cyanide dust is blown under the tent, the normal humidity releasing the gas, thereby effecting a true fumigation.

V. I. SAFRO

Calcium Cyanide as a Greenhouse Fumigant. A new principle in cyanide fumigation of greenhouses and nursery stock that is being tested by workers is that of using a lower concentration of gas over a longer period of time (over night) as contrasted with the former method of a higher concentration for a short period of time.

In the sodium cyanide-sulphuric acid method only the latter principle could be followed because of the rapidity, violence and concentration of hydrocyanic acid gas evolved.

Calcium cyanide by its property of gradual evolution of the gas permits of utilizing the former principle whereby the lower concentration of gas affords a wider margin of safety to the plants. V. I. SAFRO

Control of Leaf Cutting Ants. The leaf cutting ants in tropical and subtropical America are receiving considerable attention by the agricultural authorities of a number of countries. Successful tests by authorities of Cuba, Guatemala, Costa Rica, San Salvador, Brazil and Argentina have recently been made with calcium cyanide dust in the destruction of the colonies.

The dust is blown into the colony through one or more openings until all the galleries are filled with the dust. Complete extermination has followed a number of such treatments. In some cases a second treatment has been necessary. The Harvester ant of the United States is being controlled by a similar method in a number of localities. In the latter cases, however, calcium cyanide flakes are being used rather than the dust. One or more holes are bored into the mound and an ounce or two of flakes dropped in. It has not been found necessary to close the holes after treatment.

V. I. SAFRO

Notes on the Feeding Habits of the Tarantula. Last July a local groceryman called up the laboratory stating that a tarantula had escaped from a bunch of bananas, so we went immediately and secured it. It was placed in a large glass jar with a cloth cover over the opening. From July 9th to August 4th it ate 10 large cockroaches, by actual count, and may have eaten several smaller ones. On several occasions it pounced upon the cockroaches just as soon as they were placed in the jar. One cockroach was apparently caught before it had time to reach the bottom. The tarantula is remarkably quick in its movements.

For several days prior to August 20th, it had not eaten anything and it moulted some time during the night of August 20th. Although cockroaches were placed in the jar at more or less irregular intervals subsequently to moulting, the notes do not indicate that any were eaten after this date. In all probability it was neglected and died about September 15th. No other insects were given to it during captivity.

W. W. YOTHERS, *U. S. Bureau of Entomology*

Another Mango Pest in the Philippines. In addition to the mango pests referred to in my previous note I have recently noted that the larvae of *Parasa lorquini* Reakirt,—so identified by Mr. W. Schultz, entomologist, Bureau of Science,—feed on the leaves of the mango. The larvae had devoured approximately 30 per cent of the leaves of a small mango tree about 2.5 meters high. It is the first time that I have seen this insect attack the mango during more than 13 years residence in the Philippines, so that it is probably of little importance as a mango pest in this country. This is probably due to internal parasites as many of the larvae were parasitized.

A related species, *Parasa lipida*, feeds on the leaves of the mango in India where it is said "to be a constant danger to young grafts and seedlings which they often completely defoliate." As a pest on the old mango trees they are said to be unimportant.

P. J. WESTER

Calcium Cyanide Dust for Control of the Grape Leaf Hopper. Calcium Cyanide dust was used in an experimental way against the Grape Leaf Hopper, *Typhlocyba comes* Say, by this Station in 1923 and again in 1924. From the previous work on this insect it appeared to the writer that if some effective method could be used against the over-wintering adult hoppers soon after they came onto the vine in the spring, that it would be the most desirable way to control the hoppers, but the adults showed great resistance to sprays or dusts heretofore used. The adult hoppers, on the other hand, proved to be susceptible to HCN gas. When the Calcium Cyanide dust is blown into the vine the hoppers are quickly overcome and fall to the ground. If there are no Cyanide particles on the ground the hoppers overcome by the gas will recover, but if there is a slight deposit of the cyanide on the ground sufficient gas will be given off to prevent the recovery.

On short pruned vines the method has been to use a knapsack duster by means of which the dust is shot into the vines from below and the heavier particles drop to the ground. Since the shoots of the vine at this season are only six to ten inches long, there is not much foliage to cover and a small amount of dust will do the work. Later in the season, when the second generation hoppers occur, Cyanide dust will also kill them, although a much greater quantity must be used. It is proposed to carry on work on a larger scale during the coming year, when more definite data will be secured as to the feasibility of controlling the Grape Leaf Hopper by Calcium Cyanide dust.

H. J. QUAYLE, *Citrus Experiment Station, Riverside, California*

COMMITTEE ON GENERAL ENTOMOLOGICAL TERMS

At the Cincinnati meeting the Entomological Society of America appointed a standing committee "to recommend for adoption by the Society a preferred usage respecting such general terms as appear to be current in conflicting and confusing forms." It will probably be agreed that we ought to have some uniformity in regard to the usage of such terms as brood, generation, larva, nymph, incomplete, gradual or simple metamorphosis, correct singular and plural forms of exuviæ and a host of others that are continuously used in conflicting or confusing ways. It is believed that a good purpose would be served by a full discussion of these terms, and if possible, an agreement by all members of the society to follow some one usage for certain ones of them. All who are interested are urged to transmit their suggestions at once to one of the members of the following committee: E. M. Walker, Chairman, University of Toronto, Ontario, G. C. Crampton, W. M. Wheeler, A. L. Melander, and A. L. Quaintance.

MEETING OF CONNECTICUT ENTOMOLOGISTS

The first conference or meeting of the entomological workers of Connecticut was held at the Agricultural Experiment Station, October 31, beginning at 10:00 o'clock A. M. Invitations were extended to all official entomologists, those teaching the subject in educational institutions, field foremen of State and Federal forces working within the State, amateur entomologists, graduate students, and official entomologists in adjoining states. About 58 attended this meeting, which was called to order by Dr. W. E. Britton, State Entomologist of Connecticut, who explained the purpose of the meeting and the program presented. He then called for the election of a Chairman. Dr. Britton was elected, and introduced Professor W. L. Slate, Jr., Director of the Station, who welcomed the visitors and assured them that the Station stands for service. Dr. Britton then gave a brief account of the entomological work of the Station. The office of State Entomologist was established by legislative enactment in 1901, on account of the menace of the San Jose scale, and was charged with the inspection of nurseries, of which there were only 25 in the State: last year there were 106. Later the control of the gipsy and brown-tail moths and the inspection of apiaries were placed in charge of the State Entomologist. In 1909, gipsy moth eggs and winter nests of the brown-tail moth were brought into the United States on nursery stock, so since then all imported nursery stock brought into Connecticut has been inspected. Though control work has always been an important part of the Department's activities, some research has always been conducted. Some of the best things accomplished are life history studies of the greenhouse white fly, maple leaf stem sawfly, peach sawfly, leopard moth, imported pine sawfly, walnut weevil, bulb mite, European red mite, spittle insects, apple and thorn skeletonizer and Asiatic beetle. Most of this work has been published in a series of 23 reports, containing more than 2,000 pages, and included in the annual reports of the Station. Some 33 bulletins containing over 600 pages have also been published, besides spray calendars and other papers in co-operation with other Departments of the Station. In addition to these publications, the Department has had charge of the preparation of the manuscript of four bulletins of the State Geological and Natural History Survey, totaling 2,200 pages, and the manuscript of a fifth is now ready for publication. The Department Library now contains more than 1,000 bound volumes, and more than 3,500 unbound bulletins and separates. The State insect collection con-

tains about 5,700 determined species, perhaps 5,000 specimens undetermined, and altogether more than 50,000 specimens. We have about 3,000 photographic negatives of insects and their work and about 800 lantern slides.

Professor G. H. Lamson, Jr., Professor of Zoology, Connecticut Agricultural College, Storrs, gave a brief account of some of his work on the parasites of poultry, cattle and sheep.

Mr. M. P. Zappe, Assistant Entomologist, Agricultural Experiment Station, New Haven, then gave an account of the Asiatic beetle, *Anomala orientalis* Waterhouse, which has appeared near a nursery in the western part of the city of New Haven, damaging lawns by eating off the grass roots. It was first collected in July, 1920, and in the fall of 1922, people in that vicinity began to complain of injury to lawns. Presumably it may have been introduced in balls of earth on nursery stock imported from Japan. Life history studies have not yet been completed, and we do not yet know whether the life cycle requires one or two years. Both cyanide and carbon disulphide emulsion were applied to the lawns, and in some instances each gave as high as 100 per cent. kill, but on account of the local conditions and the danger connected with the use of cyanide, we prefer the carbon disulphide emulsion. Most of the larvae are within two inches of the surface when feeding, but go deeper to pass the winter. The larva pupates in cells in the soil late in June, and the adults appear two weeks later. They do not fly much and are found rather close to the ground.

Professor J. A. Manter, Instructor in Entomology, Connecticut Agricultural College, Storrs, distributed an outline of the courses in Entomology given at the College, and described these courses briefly. Students taking entomology at the College fall into three groups: (1) short course of 20 weeks; (2) students in Agriculture, Horticulture, Forestry and Animal Husbandry, who need to know something about the insects which affect their crops and animals; (3) students specializing in entomology. The students of the third group are urged to take summer jobs where they can work on insect problems, thus acquiring practical experience.

Professor Alexander Petrunkevitch, Professor of Zoology in Yale University, referred to the general interest in entomology as manifested by attendance at meetings, yet it is one of the last subjects to be taught in American Universities. He related his experiences in teaching undergraduate entomology at Yale under somewhat trying circumstances. Students were required to identify insects by their structural characters. Formerly this course was required of all men preparing to enter the School of Forestry. Now it is no longer required.

Professor W. R. Coe, Professor of Biology in Yale University, explained his course in Forest Entomology at Yale. It consists of three-hour periods, and there are 20 exercises of laboratory and field work. The students are shown injuries to living trees, sawlogs and finished products, are taught to distinguish between injurious and beneficial insects and are made acquainted with methods in insect control. It is unfortunate that the course must be given in winter.

The subject of teaching entomology was discussed by Mr. A. F. Burgess, who emphasized the importance of practical field work in insect control. Such information cannot be obtained from books, and most of the men graduating from our institutions have only a theoretical knowledge. There seems to be a good opportunity for demonstrations and field practice at Storrs. The diffusion of knowledge cannot be restricted to a single center but must come from many different sources and from

different angles and viewpoints. He regretted that entomology has not had the opportunity to develop at Yale as at Cornell, Illinois and many other Universities.

Professor L. B. Crandall, Extension Specialist in Beekeeping at the Connecticut Agricultural College, Storrs, discussed the opportunities for beekeeeping in Connecticut. Most beekeepers practice beekeeping as a side line, and the older ones will not change their methods. The greatest hope for the future of the industry in Connecticut lies in interesting the younger men and women in the subject.

Mr. L. H. Worthley, Agent in Control of European Corn Borer, Bureau of Entomology, addressed the meeting on the discovery, spread and present distribution of the European corn borer in the United States. He explained the methods of control, quarantine enforcement, and how the Bureau of Entomology carries on this work in co-operation with the States which are infested. This infestation now includes all of the New England States, New York, Pennsylvania, Ohio and Michigan. Ontario, Canada, also has a large area infested just north of Lake Erie. Mr. Worthley showed these areas on a large map, and called attention to an exhibit of photographs and specimens in the rear of the hall.

Mr. Donald J. Caffrey, who has charge of the European Corn Borer Laboratory, maintained by the Bureau of Entomology at Arlington, Mass., spoke of the light infestations found along the Connecticut shore, and called attention to the fact that two generations occur annually at the Long Island infestation as in eastern New England, and the borers are found in both corn and weeds. In the infestations around Albany, and surrounding Lake Erie, there is only one brood of larvae, and they are found almost wholly in corn. The double-brooded borers attack 200 different plants, and they increase many times faster than the single-brooded insect. In Connecticut, much sweet corn is grown for seed. This is left for a long time in the field and if subject to two broods of borers, will be injured much more than by the one-brooded insect. In the dent corn belt of Hungary, where there is only one brood, there is seldom any injury to the ears, but all occurs in the stalks. This, however, affects the size of the ears. In regard to parasites, only slight parasitism is claimed by European writers, but since the Bureau established a laboratory for this purpose in France, Dr. Thompson has found eight or ten parasites present in appreciable abundance. These have been multiplied and liberated in this country. Some are 50 per cent. effective, and two have been recovered.

At 12:30 a recess was declared and nearly all went to the Yale Dining Hall and partook of a cafeteria luncheon, reconvening at 1:45 P. M.

Mr. R. B. Friend, Assistant Entomologist, Agricultural Experiment Station, New Haven, gave an account of his experience in trapping cabbage maggot flies during the past season. Though many different baits were tested, one of the most effective consisted of the residue left from a partial distillation of an alcoholic extract of the cabbage plant, mixed with honey, yeast and water. This was placed in the pans of Hodge fly traps distributed in the field perhaps twenty feet apart. In one experiment with 12 traps, 1841 female and 583 male flies were captured between May 16 and June 10. About 80 per cent. of the females contained eggs. The numbers given include two species, the cabbage maggot, *Hylemyia brassicae* Bouché, and the seed corn maggot, *Chortophila cilicrura* Rondani. There was only a slight infestation of plants by the cabbage maggot where the traps were used.

Mr. B. H. Walden, Assistant Entomologist, Agricultural Experiment Station, New Haven, in Hints on Photographing Insects, explained the development and

construction of lenses and the advantages of anastigmatic lenses over other types for scientific work. The most convenient outfit for photographing field operations is a small camera of the roll film type. The use of short focus lenses for laboratory photography was discussed, including micro-lenses for direct enlargements. He also mentioned the use of cut films in place of glass plates.

Mr. John T. Ashworth, Deputy in Charge of Gipsy Moth Work under the State Entomologist, with headquarters at Danielson, described the field work in suppressing the gipsy moth. Fifty-two towns were scouted and 21 others partially scouted last year by State men, besides some 25 towns along the border of the infested region which were covered by Federal scouts. Each crew is provided with a Ford light delivery truck in which they go to and from their boarding place. Egg-clusters are creosoted, and the worst infestations sprayed the following summer. This work is done in co-operation with the Federal Bureau of Entomology. Infestations are slight and scattered in Connecticut, and due to the control work, there has never been any stripping. In that part of the area longest infested, the gipsy moth is not as prominent as it was six years ago, and it is believed that the parasites are holding it in check.

Mr. A. F. Burgess, Melrose Highlands, Mass., who is in charge of the Federal gipsy moth work, referred to the satisfactory co-operation in this work between Federal and State forces, and called attention to the danger in the present conditions. People do not see damage and do not realize that the gipsy moth may again increase and therefore may not make adequate appropriations for the work. Ten years ago conditions in New England were certainly alarming. Now there is little stripping anywhere. Much research is necessary to develop the best control methods, and the quarantine regulations probably have prevented much dissemination of the pest. Parasites have been collected in Europe and other countries, reared in the laboratory and liberated in the infested area. The gratifying results now apparent should not be attributed wholly to the work of parasites. Creosoting, spraying and low temperature have all helped to reduce the pest and no man can tell whether this combination will continue. Mr. Burgess explained the barrier zone plan and gave a favorable report on the work of eradicating the pest in New Jersey.

Mr. Samuel S. Crossman, of the Parasite Laboratory in Melrose Highlands, Mass., gave an account of his recent trip to Europe in search of gipsy moth parasites, describing various conditions which he found there.

Dr. Philip Garman, Assistant Entomologist, Agricultural Experiment Station, New Haven, gave a history of the Oriental peach moth in Connecticut, and reported its increase and spread in 1924. The pest was discovered in Stamford in 1917, larvae were found there in 1918, but little trace of the insect was again seen until in 1923, when it caused serious injury to fruit in one orchard in Greenwich. In 1924, the damage was even greater and the pest occurred throughout the southwestern third of the State, and one report of wormy peaches came from central Connecticut near the Massachusetts line. The larvae winter in cocoon-like cases on the bark near the ground and probably emerge late in May or early in June; they first appeared in twigs at Greenwich about the middle of June in 1924. The first infested fruit was found July 14. There are probably three broods in Connecticut, the third hibernating. Eggs are laid on the leaves and hatch in from four to eight days. Adults fly actively late in the afternoon. The larvae often leave their twigs and enter other twigs or fruit. Cocoons are made anywhere on the tree or ground. One parasite has

been reared in Connecticut but not identified. Dr. Garman reported on nicotine sprays to kill the eggs as practiced in the Middle Atlantic States and mentioned his own experiments in Connecticut which gave only partial control.

Mr. R. C. Botsford, Deputy in Charge of Mosquito Elimination, Agricultural Experiment Station, New Haven, was the last speaker and gave a brief history of anti-mosquito activities in Connecticut, habits and life history of mosquitoes, and explained the work carried out during 1924, most of which was maintenance. Some new dikes were built and culverts and tide gates installed.

Messrs. Zappe, Friend, Walden, Garman and Botsford illustrated their talks by lantern slides.

There were a number of opinions expressed, all to the effect that the meeting had been a success and a hope that other meetings may be held in the future. The following were present: Mr. and Mrs. A. F. Burgess, A. F. Burgess, Jr., C. W. Collins, H. L. Blaisdell, S. S. Crossman, Melrose Highlands, Mass.; L. H. Worthley, D. J. Caffrey, R. A. Vickery, T. M. Cannon, Arlington, Mass.; Mr. and Mrs. Albert Hartzell, Yonkers, N. Y.; H. C. Huckett, Riverhead, N. Y.; H. J. Evans, Mineola, N. Y.; D. G. Murphy, Pittsfield, Mass.; H. A. Ames, Bound Brook, N. J.; Professors Alexander Petrunkevitch and W. R. Coe, Yale University, New Haven, Conn.; Professors G. H. Lamson, Jr., J. A. Manter, L. B. Crandall and A. J. Grady, T. F. Cronin, V. A. Johnson, J. W. Balock, Storrs, Conn.; F. C. Rich, Ansonia, Conn.; W. A. Collins, New Milford, Conn.; J. J. Pillsbury, Burnside, Conn.; Professor Pauline H. Dederer, Connecticut College for Women, New London, Conn.; S. E. May, Canaan, Conn.; P. H. Meagher, Wallingford, Conn.; John T. Ashworth, J. W. Longo, A. J. Gilbert, H. A. Woodmancy, H. E. Cook, O. B. Cooke, C. M. Spencer, Danielson, Conn.; Dolor LaBelle, Ballouville, Conn.; James A. McEvoy, Putnam, Conn.; A. W. Yates, Hartford, Conn.; H. W. Coley, Westport, Conn.; E. J. Smith, Clintonville, Conn.; Mr. and Mrs. Henry S. Woolley, Waterbury, Conn.; P. L. Buterick, New Haven, Conn.; Robert E. O'Brien, New Haven, Conn.; and Messrs. W. L. Slate, Jr., E. H. Jenkins, G. P. Clinton, E. M. Stoddard, G. E. Graham, Philip Garman, M. P. Zappe, B. H. Walden, R. C. Botsford, R. B. Friend, Leslie Rogers and W. E. Britton of the Agricultural Experiment Station, New Haven, Conn.

W. E. B.

JOURNAL OF ECONOMIC ENTOMOLOGY

OFFICIAL ORGAN AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

DECEMBER, 1924

The editors will thankfully receive news matter and other items likely to be of interest to our readers. Papers will be published as far as possible in the order of reception, except that papers of reasonable length may be accepted in the discretion of the editor for early publication, at $3.00 per page for all matter in excess of six printed pages; in the case of other matter, the maximum of 2,500 words is still operative. Photo-engravings may be obtained by authors at cost.

Separates or reprints, if ordered, when the manuscript is forwarded, will be supplied to authors at the rates given below. Note that the number of pages in a reprint may be affected somewhat by the make-up, and that part of a page is charged as a full page. Carriage charges extra in all cases. Shipment by parcel post, express or freight as directed.

One hundred separates or reprints at $2.00 per page or plate. Additional hundreds or less, 4 pages or less, $1.00; 5-8 pages, $1.50; 9-12 pages, $1.75; 13-16 pages, $2.00; 17-24 pages $3.00; 25-32 pages, $4.00. Covers suitably printed on first page only, 100 copies, or less, $4.50; additional hundreds, or less, $1.75. Plates inserted, $1.75 per hundred, or less. Folio reprints, the uncut folded pages (50 only), sixteen page signature, or less, $3.00.

This issue has been delayed a little by the loss in the mails of a somewhat large sending of manuscript. It is the first experience of the kind which has befallen the editor in some seventeen years. Fortunately most of the lost matter had been duplicated by the Associate Editor and was therefore quickly available.

The recent appearance of pneumonic plague on the Pacific coast is a serious matter, though the earlier record of California in exterminating rats for the control of the bubonic form of this most dreadful disease gives assurance that no efforts will be spared to eradicate this most deadly affection. Unlike the bubonic type, the pneumonic form may be transferred from person to person, since the plague bacillus occurs in the sputum; consequently control is more difficult. There is no occasion for alarm. There is every reason to believe that the situation is being handled in the best possible manner, a protective serum even being shipped from the east by airplane. There were tremendous losses of life following the introduction of influenza and were it not for recent knowledge concerning plague and the methods of its dissemination, this latest introduction might mean a national disaster. National and state health officers fully appreciate the dreadful possibilities and we may rest assured that no stone will be left unturned in an effort to guard the health of the American people. In this connection, it is well to remember that the most serious human costs of wars have not been losses in the field nor even the losses from disease in armies, but those resulting from epidemics disseminated among the civil populations. A monographic account of these sequelae of wars, by Dr. Friedrich Prinzing,

was published by the Carnegie endowment for international peace in 1916. A number of the most deadly affections developing during wars or as a result of conditions following such disturbances, are disseminated by insects and assistance in controlling such therefore falls within the province of economic entomology, particularly that division known as medical entomology, a phase of applied science which has come rapidly to the front within recent years.

Review

An Introduction to Entomology by JOHN HENRY COMSTOCK. pp. i–xix, 1–1044, 1228 figures, First Complete Edition, Third Edition of Part I, Comstock Publishing Co., Ithaca, N. Y., 1924.

This is the long expected revision of the Manual for the Study of Insects which has been the standard with American entomologists for many years. It is really a re-written work with an added and extensive account of the structure and metamorphoses of insects, the latter published in a separate edition and now re-printed for the third time. The author's nearly fifty years of active study of insect life in its various phases, most of the time in positions where all that was best would come to him and with the large resources of a great university and its strong department of entomology at his command, has made possible a comprehensive, authoritative account of the structure and biology of American insects. The cooperation of the author's associates, especially Messrs. Bradley, Forbes, and Johannsen, has added materially to the value of the "Introduction." There is also an admirably selected bibliography. It is the work of a master, and bids fair to remain the standard treatise for many years to come.

E. P. FELT

Current Notes

Messrs. Geo. A. Dean and L. H. Worthley called at New Haven, Conn., October 17, on a trip to visit the European corn borer infestations.

Dr. William Colcord Woods, formerly instructor in biology, Wesleyan University, Middletown, Conn., resigned since the close of the college year to accept a position at Kent School, Kent, Conn.

Dr. F. A. Fenton, of the Bureau's boll weevil laboratory at Florence, S. C., visited the Baton Rouge, La., laboratory during the middle of September and conferred with Bureau and State officials.

Mr. George N. Wolcott, of Hayti, recently called at the Division of Insects, U. S. National Museum, bringing with him specimens to have identified, and consulted the specialists regarding some of his taxonomic work.

Dr. Mortimer D. Leonard, formerly associate State Entomologist of New York, has returned to the United States after spending three months in Spain where he studied methods of combating the Mediterranean fruit fly.

Dr. H. H. Knight, curator of insect collections of the University of Minnesota, University Farm, St. Paul, Minn., has resigned to accept a similar position at the Iowa Agricultural College and Station at Ames, Iowa.

Messrs. Stewart Lockwood and F. W. Boyd, of the Billings, Mont., laboratory of the Bureau of Entomology, attended the conference of the Northwest International Committee on Farm Pests, held at Bozeman, Montana, August 27 and 28.

Dr. J. M. Swaine, Entomological Branch, Canadian Department of Agriculture, was admitted to the hospital on August 10 and successfully operated on for appendicitis. He is convalescing most satisfactorily.

Prof. A. F. Conradi, for many years professor of zoology and entomology at the Clemson Agricultural College, entomologist of the South Carolina Experiment Station, and State Entomologist, has resigned to enter the field of commercial entomology in South Carolina.

Messrs. J. S. Houser, L. L. Huber and C. R. Neiswander of the Ohio Station recently accompanied a party of entomologists on an inspection of Canadian corn fields. The increase in borer infestation was very pronounced and considerable damage is being done.

At the forty-ninth annual meeting of the Georgia State Horticultural Society, held at Griffin, Ga., August 6, Mr. Oliver I. Snapp of the Bureau of Entomology gave an address on the year's development in the control of peach insects.

Messrs. Nicolai, Shoemaker and Quersfeldt, of New York, recently spent a week doing miscellaneous collecting in the vicinity of Washington and visited the Section of Insects, U. S. National Museum, to meet the members of its force and consult with the coleopterists.

According to *Science*, Dr. Vernon Kellogg has been appointed by the Department of State as one of the official representatives of the United States to the third Pan-American Congress to be held at Lima, Peru, from December 20 to January 6.

The entomological laboratory of the Bureau of Entomology at Ritzville, Wash., in charge of M. C. Lane, has been moved to Toppenish, Wash., a location believed to be more advantageous for the co-operative studies on the wireworms injurious to potatoes, wheat, and other crops.

Dr. F. H. Lathrop of the New York (Geneva) Agricultural Experiment Station, recently of the field station at Poughkeepsie, has been appointed State Entomologist of South Carolina, entomologist of the Station and professor of zoology and entomology in Clemson College, vice A. F. Conradi, resigned.

A list of corrections and additions to the "Hemiptera of Connecticut," Bulletin No. 34, Connecticut Geological and Natural History Survey, has been printed. Anyone who has received Bulletin 34 may obtain the list by applying to Mr. Geo. S. Godard, State Librarian, Hartford, Connecticut.

Mr. David Dunavan, temporarily in charge of the Toppenish, Wash., truck crop laboratory of the Bureau of Entomology, attended the meeting of horticulturists, pathologists, and entomologists, held at Penticton, B. C., but has now returned to the Oregon Agricultural College to complete work for his degree.

Mr. Fred M. Schott of Brooklyn, N. Y., recently in the service of the State of New Jersey, was for a week, while in Washington, a frequent visitor to the Division of

Insects, U. S. National Museum, and brought with him a number of insects for identification by the specialists.

Mr. William Schaus of the U. S. National Museum, went to Pittsburgh toward the end of September to consult with Dr. Holland, examine types in the Carnegie Museum, and return material which had been sent him for study. Mr. Schaus has recently completed a paper on certain African Lepidoptera.

The Sugar Cane Insect Laboratory of the Bureau of Entomology at New Orleans, La., was moved September 29 to rooms 6 and 7, Wilson Building, 8,200 Oak Street, New Orleans. The new location is one block above Carrolton Avenue and can be reached by St. Charles and Tulane Belt cars.

At the Entomological Branch, Canadian Department of Agriculture, the following resignations have been announced: Mr. G. S. Walley, Seasonal insect pest investigator and Fred P. Ide, seasonal laboratory assistant, to attend the University of Toronto: Misses Forward and M. Bonell, the former to continue her studies at the University of Toronto.

Mr. D. J. Caffrey, in charge of the corn borer investigational work of the Bureau of Entomology made a tour of inspection throughout the infested area during the latter part of August, spending several weeks visiting and inspecting the various laboratories and the more recently infested sections of the Lake district.

Mr. Fred E. Brooks in charge of the French Creek, W. Va., laboratory of the Bureau of Entomology, discussed the more important insects attacking nuts and nut trees in the northern states before a meeting of the Northern Nut Growers Association, held at the Botanical Garden, New York City, September 3–5.

Transfers in the Bureau of Entomology have been announced as follows: T. C. Barber, from sugar cane insects to cotton hopper, Brownsville, Tex.; S. C. Brummitt, from Silver Hill to Grand Bay, Ala., sweet potato weevil eradication; C. H. Popenoe, from Silver Spring, Md., to Washington, D. C.; J. C. Shiver, Melrose Highlands, Mass., to Columbia, S. C.

The following appointments to the Bureau of Entomology have been made recently: Leslie W. Orr, temporary field assistant, St. Paul, Minn.; Curtis Benton, stored product insect investigations, Fresno, Calif.; Wallace Coleman, Junior entomologist, bean beetle work, Birmingham, Ala.; Walter Baldwin, Riverside, Calif.; L. P. O'Dowd and Daniel D. Ewing, Jr., temporarily, during October, November and December, La.

Mr. William Middleton of the Bureau of Entomology recently returned from New York where he met the Fabre Liner *Providence*, on which was a shipment of parasitized elm leaf-beetles from Dr. W. R. Thompson in France. An attempt is to be made to establish the dipterous parasite, *Erynnia nitida* R. D., of the elm leaf-beetle in this country.

Dr. H. C. Fall, the well known Coleopterist of Tyngsboro, Mass., visited Otta wa in early August on his return from an Alaskan trip and spent a day studying the Coleoptera in the National Collection. He expressed himself as much impressed by the excellent showing of the collection and promised to help in any way possible to add to its completeness.

Mr. Leonard S. McLaine, accompanied by Mrs. McLaine, returned to Ottawa from their trip to England on Saturday, August 2. While in England, Mr. McLaine

attended a very interesting Imperial Conference, called by the British Ministry of Agriculture and Fisheries, to consider Imperial Legislation in connection with the exchange of plants and plant products throughout the Empire. This conference was held on July 17.

Entomological News records the death of the following entomologists: Philippe Grouvelle, August 2, 1923; Jules Grouvelle, November 6, 1923, both coleopterists of France; Edmond Bordage (date not given) also of France; Charles Oberthur, the great lepidopterist, June 1, Rennes, France; Frederick Merrifield, May 28, 1924, Brighton, England, a lepidopterist; Dr. David M. Castle, a coleopterist and member of the Feldman Collecting Social, Philadelphia, August 6, 1924.

Mr. H. L. Viereck, who was definitely appointed to the position of assistant entomologist in the Division of Systematic Entomology, Canadian Department of Agriculture, on August 1, has marshalled all of the Hymenoptera in the National Collection so that it is now possible to tell when one looks at a species, whether all the available material is at hand. Mr. Viereck has also made considerable progress in the listing of Canadian Hymenoptera and the work is nearing completion.

Mr. M. J. Forsell of Everett, Washington, has recently been appointed junior plant quarantine inspector with the Federal Horticultural Board, and stationed at Seattle, Wash. Previous to this he was horticultural inspector with the State of Washington Department of Agriculture where in addition to his usual duties, he made a special study of the strawberry root weevil, working out the life history and making special migration studies. This pest is the most puzzling problem of all among the berry growers of the Puget Sound region.

Prof. W. M. Wheeler of Harvard University has sent to the U. S. National Museum paratypes of an extraordinary larval myrmecophile which he collected in Panama and recently described as *Nothomicrodon aztecarum*, new species. They are very small insects with no legs and few organs, shaped like a little bag or flask with the head sticking out at one end. It is supposed that they belong to the Diptera, but it is impossible to tell with any certainty to what family, as no one has previously found anything like them.

Mr. C. N. Ainslie, entomologist, in charge of the Sioux City laboratory of the Bureau of Entomology, visited Beach, N. D., during August, to investigate a severe infestation of the Hessian fly in western North Dakota, where he found the insect more abundant and injurious than for many years. He gathered valuable notes relating to the insect and its parasites in an unusual environment. He also planned a trip to northeastern Montana to confer with Dr. J. R. Parker of the Montana Experiment Station concerning the new infestation of Hessian fly in that State.

Captain Bartlett, who commanded the vessel "Roosevelt" on Peary's expedition to the North Pole, called on Dr. Aldrich at the U. S. National Museum October 1, to clear up some questions concerning specimens collected on the expedition. The specimens had been previously sent to the Museum in pill boxes, with only the date and locality of collection. It is believed that as a result of this conference with Captain Bartlett more information will be available, the specimens will be of more value, and a more accurate record will be preserved of the entomological results of the expedition.

Prof. Geo. A. Dean returned to Washington September 16 from an extensive trip to several of the entomological laboratories of the Division of Cereal and Forage Crop

Insects, located in the Northwestern, Central, and Southern States. While in the Northwest he attended the conference of the Northwest International Committee on Farm Pests, held at Montana Agricultural College, Bozeman, August 27 and 28. Prof. Dean reports a decided improvement in the grasshopper situation in the Northwestern States. The loss by grasshoppers during the past season has been very much less than that of the years 1922 and 1923. He also reports splendid results by the entomologists of the Billings, Mont., laboratory in the control of the Mormon cricket with the poisoned bran mash and by the entomologists of the Salt Lake City laboratory in the control of the alfalfa weevil with arsenical dust.

The following resignations from the Bureau of Entomology have been announced: L. B. Sanderson, field assistant in insect control, cereal and forage crop investigations; Bruce Lineburg, bee culture investigations to accept a position as instructor in Lake Forest University; E. W. Tschudi, bee culture laboratory, to resume his work at Johns Hopkins University; W. B. Wheelis, bean beetle work, Birmingham, Ala.; S. T. Howard, mechanical engineer, boll weevil laboratory, Tallulah, La.; C. P. Barber, R. M. Foster, H. S. Hollingsworth, J. M. Hyman, LeRoy Johnson, J. G. Lewis, E. E. Lumpkin, L. G. McGraw, D. A. McIntosh, A. H. McMullen, B. J. Nuckols, P. J. Pace, R. A. Robinson, J. G. Sevier, F. A. Smith, P. E. Stephens, J. C. Wilkerson and R. D. Williams of the Southern Field Crop investigations; B. E. Montgomery, field assistant, Vincennes, Ind., for graduate study at Purdue University; H. L. Weatherby, Ala.; L. M. Berthoif, bee culture investigations, to accept an instructorship in biology at Western Maryland University; Carlton Burnside, bee culture investigations, to resume graduate study, University of Michigan: Samuel Blum, Junior Entomologist, Columbia, S. C.

Since the latter part of July a staff of thirty-five men has been engaged on Canadian gipsy moth work and all territory along the border is being examined. The first record of the gipsy moth in Canada was taken by Mr. A. K. Gibson, Crew Foreman, on July 29 near the town of Stanstead in Stanstead County. A very serious infestation was also found by Mr. A. Magnan, Crew Foreman, on September 3 about four miles southwest of Lacolle Village in St. John's County, and investigations have shown that this outbreak is at least three years old. Scouting carried on to date shows that the infestation extends over an area of at least six hundred yards square. Although a comparatively small number of trees are included in the infestation, clean-up work will be greatly handicapped on account of the presence of many stone walls situated on the infested properties, and the large number of egg-masses within these walls. Egg-masses were also discovered on and within the various farming buildings.

At the Ohio Agricultural Experiment Station, Wooster, the new chemical and biological building, known as Thorne Hall, will be ready for occupancy about the first of January. The entomological department will occupy the second floor of the east wing of the building, and the quarters include a library and collection room in the northeast corner of the building, fronting the north. This room is 36′ x 14′, has 5 windows to the north and two to the east. A hallway five feet wide runs the length of the east wing and through the center of the wing. East of the hallway is an outfit of five offices, the office of the Chief, next to the library, being 20′ x 12′, with three windows to the east. Then comes a series of four offices, each 11′ x 12′, and each having two windows to the east. Then comes a small office or storeroom, 8′ x 12′, with one window to the east. At present it is planned to use this as a storeroom for

chemicals and as a preparation room for museum material. Extending across the south end of the wing is a laboratory 30′ x 16′. It has two windows to the east, four to the south and two to the west, being splendidly lighted. This will be equipped with tables, electric ovens, water, sink, etc. On the west side of the hall-way is a museum and collection room, 33′ x 16′, with six windows to the west. It is planned to use this for economic exhibits, life history displays, and such museum material as will interest and instruct visitors. The systematic collections and Schmitt boxes will probably be kept in the library room. In the basement here is a large room extending the width of the entire wing, 25 or 30 to 40 feet in depth, in which can be stored insecticides and heavy material and types of spraying machinery for the education and instruction of the public. At a short distance from these quarters a greenhouse and insectary will be constructed within a year or two.

The foreign gipsy moth (*Porthetria dispar* L.) parasite investigations have been continued during the season of 1924. Messrs. S. S. Crossman, R. T. Webber, and S. M. Dohanjan went to Europe in the latter part of February in search of gipsy moth parasites for introduction into the infested area of the United States. After spending a few days at Paris, interviewing several entomologists, Messrs. Crossman and Dohanian proceeded to Spain, and Mr. Webber went to Poland and Hungary. Several medium to heavy gipsy moth infestations were visited in Spain, and through the kindness of Dr. M. Aullo, Director of the Laboratory of Forest Fauna of Spain, arrangements were made to use two of his field stations for the season. Mr. Dohanian remained in Spain during the season to carry on the investigations. Messrs. Crossman and Webber spent most of the season in Poland, Hungary, Yugoslavia and Bulgaria. After finding suitable infestations in each of these countries, temporary field laboratories were established. In addition to these countries, parts of Rabat and Algiers in northern Africa, France, Austria, Germany, Roumania, Czecho-Slovakia, Sardinia and Sicily were searched for *P. dispar* infestations. No infestations of suitable size for parasite introduction work were found in the latter-named countries, excepting in Algiers and Rabat. Arrangements were made at Algiers to have shipments of gipsy moth larvae sent to Melrose Highlands during the season. At Rabat a heavy infestation was found, and Dr. Liouville, Director of the Institute Scientifique Cherifien, planned to have a study of the parasties of *P. dispar* made at Rabat this summer. Should this investigation show any valuable gipsy moth parasites present which have not already been introduced into America, arrangements can be made to carry on such work. During the spring and summer about 85,000 tachinids were sent to Melrose Highlands. Of these importations, about 50,000 are *Parasetigena segregata* Rond., and 19,000 *Blepharipa scutellata* R. D. These two species have only one generation each year, and they have been placed in hibernation at the laboratory. The remaining material is composed of species having more than one generation annually, and in most cases the adults had issued and died before reaching Melrose Highlands. The species involved are *Sturmia gilva* Hartig, *Carcelia gnava* Meig., *Compsilura concinnata* Meig., and *Tricholyga grandis* Zett. In addition a few specimens of *Chalcis intermedia* Nees, and a few cocoons of a species of Hyposoter, *Apanteles fulvipes* Hal., *A. vitripennis* Hal., *A. melanoscelus* Ratz., were sent to Melrose. Also about 1,000 adults of *Carabus* sp., Reiche and a few *Calosoma inquisitor* L. were sent to the laboratory. A few adults of *Silpha quadripunctata* L. were shipped, but all were dead when received in the States. S. S. Crossman and S. M. Dohanian returned to the Gipsy Moth Laboratory in August and R. T. Webber early in September.

Horticultural Inspection Notes

Mr. R. K. Beattie of the Federal Horticultural Board recently returned from an extensive inspection trip in the Northern and Western States.

Mr. F. A. Johnston, Plant Quarantine Inspector of the Federal Horticultural Board has been transferred from Washington, D. C. to El Paso, Texas.

Mr. H. H. Willis has resigned his position as Associate Plant Quarantine Inspector in charge of the activities of the Federal Horticultural Board at El Paso, Texas.

Two shipments of Spanish grapes arriving in New York recently were found to be infested with the Mediterranean Fruit Fly. Both of the consignments were refused entry.

St. Louis has been made a port of entry for plant material, and Mr. H. A. Horton, who formerly served in the capacity of Plant Quarantine Inspector at Seattle, Wash., has been placed in charge.

Mr. O. D. Deputy, Plant Quarantine Inspector in charge of the work of the Federal Horticultural Board at Brownsville, Texas, recently visited the various ports on the Mexican Border for the purpose of co-ordinating the work.

The Federal Horticultural Board has established an office in Chicago, and Mr. L. M. Scott, who has been stationed at Boston in the capacity of Plant Quarantine Inspector, was transferred to Chicago to take charge of the work.

At the request of nurserymen interested in the subject, a conference was held at Washington on Nov. 26, 1924, for the purpose of considering the desirability of revising the Federal "White Pine Blister Rust" Quarantine No. 26. The conference was well attended by nurserymen and State and Federal officials.

Mr. H. L. Sanford of the Federal Horticultural Board has been investigating fruit fly conditions in Cuba and the Isle of Pines. He was accompanied by Mr. Warner of the Florida State Plant Board on his first trip, and on the second trip by Mr. Moznette of the Bureau of Entomology.

Oranges coming from the Argentine Republic, affected with brown spots, were recently intercepted in ship's stores at New York City by inspectors of the Federal Horticultural Board. An examination of the fruit sent to Washington showed it to be attacked by a disease somewhat similar to the Citrus scab, which is already in this Country. The disease found, however, is quite distinct and was not recognized as one which is known here.

Mr. L. A. Strong, in charge of Port Inspection with the Federal Horticultural Board, has returned from a trip to the Southern Ports. While in the South he visited Charleston, Savannah, Jacksonville, Miami, Key West, Tampa, Mobile, New Orleans, and Galveston, to study shipping conditions at these places, with a view of making improvements in the inspection service. He addressed a meeting at the Florida Agricultural College in Gainesville, in connection with their Farmers & Fruit Growers Week.

Dr. W. M. Mann of the Bureau of Entomology has been investigating the Mediterranean Fruit Fly situation in Spain, Portugal, Southern France, and other Mediterranean regions, for the Federal Horticultural Board, in order that definite information might be available in regard to the danger of introducing this insect and other serious pests with importations of fruit. The investigation has been completed, and Dr. Mann will return to the United States shortly.

Mr. R. S. Hawkins, temporary Insect Pest Inspector at Fredericton, N. B., Laboratory, resigned on September 8.

Mr. Alfred Lutken, a graduate of the Agricultural and Mechanical College of Mississippi, has been appointed Plant Quarantine Inspector for duty at the Honolulu, Hawaii, station. Mr. Lutken has had two years' experience as Assistant Inspector for the State Plant Board of Mississippi.

A staff of four inspectors is now engaged in the examination of vegetables shipped from the Windsor district to the United States, and up to July 12, certificates were issued for the export of beets and beans to the value of $10,000.00 and oat straw grown in various parts of the province, amounting to the value of about $1,500,000.00.

On July 1, a Regulation was passed by the Federal Horticultural Board prohibiting the export of Christmas trees from all townships along the international border in southern Quebec, on account of the danger of spreading the Gipsy Moth to uninfested portions of the United States. The protection of the balance of Quebec and Canada has also been provided for through a Domestic Quarantine which was passed on September 3 as Regulation No. 7, placing an absolute quarantine on the bordering townships in southern Quebec covered by the United States Regulation and also placing under restriction the townships adjoining this area on the north and west, which prohibits the movement of Christmas trees from this area unless accompanied by a certificate of origin issued by this Department. To date a total number of 5990 permits have been issued to cover shipments of nursery stock from the United States and a total number of 4153 permits to cover importations from other countries.

Apicultural Notes

The fall meeting of the Connecticut Beekeepers Association was held in Hartford, October 25.

The annual meeting of the Georgia Beekeepers Association was announced for October 29–30 at Savannah. Mr. L. C. Walker, Alma, Ga., is Secretary of this organization.

The annual meeting of the Alabama Beekeepers Association was scheduled to be held in the Chamber of Commerce Auditorium, Montgomery, Ala., on November 6. Mr. M. C. Berry is Secretary.

Announcement was made of the annual meeting of the Northern Illinois and Southern Wisconsin Beekeepers Association on October 21 at Freeport, Ill. Mr. B. Kennedy, Rockford, Ill., is the Secretary.

About 250 people from the United States, Canada, and Europe, attended the Seventh International Apicultural Congress held at Quebec, September 2 to 4. The Bureau of Entomology was represented by E. F. Phillips and James I. Hambleton.

Mr. W. J. Nolan of the Bureau of Entomology attended the meeting of the North Carolina State Beekeepers' Association at Winston-Salem, September 10. Messrs. E. S. Prevost and C. L. Sams, formerly extension workers with the Bureau, but each now engaged in similar work for South Carolina and North Carolina respectively, were also present.

Included among the visitors at the Bee Culture Laboratory of the Bureau of Entomology during the month of October were: Dr. E. F. Phillips, now Professor of

Apiculture in Cornell University; Mr. George S. Demuth, editor of *Gleanings in Bee Culture;* Mr. Robert Dumn, art editor of *Farm and Fireside;* Mr. M. S. Smith, rehabilitation worker in beekeeping at the University of Indiana; and Mr. Ph. J. Baldensperger, the French delegate to the recent International Apicultural Congress at Quebec.

Mr. Baldensperger has an international reputation as an authority on beekeeping, especially as to races of bees. He has had an exceptional opportunity to make inves tigations along this line, both because of extensive travels in northern Africa in quest of native races of bees and because of many years of experience in beekeeping in Palestine and France. As a result of his experience with many different races, Mr. Baldensperger believes that a certain race native to the Sahara, which he calls the Saharan race, is equal to or better than any other race he has dealt with. Mr. Baldensperger is also editor of the *Bulletin de la Société d'Apiculture des Alpes Maritimes*, besides being known as a writer on archaeology and affairs dealing with Palestine. During his visit in Washington he delivered lectures at the Bee Culture Laboratory, at the Rhode Island Avenue Presbyterian Church, and before the Biological Society of Washington.

The paper by Dr. A. P. Sturtevant of the Bee Culture Laboratory, of the Bureau of Entomology entitled "The Development of American Foulbrood in Relation to its Causative Organism," appeared in a recent issue of the *Journal of Agricultural Research*. According to Doctor Sturtevant the larval intestine before the seventh day contains so large a percentage of reducing sugar as to inhibit the growth of *Bacillus larvae*. By the seventh day, however, the concentration of this sugar becomes reduced sufficiently to allow active growth of *Bacillus larvae*. This explains why American foulbrood occurs for the most part only during the later stages of larval development.

Acarapis woodi is being found to be more widely distributed than was generally believed at first. It has now been found in apiaries of the German-speaking portion of Switzerland, as well as around Salsburg, Austria. Dr. Enoch Zander, of Germany, who examined the latter outbreak on the spot during the past summer, states that it is far from being a sporadic occurrence. Doctor Zander recently published a comparison of the disease caused by *Acarapis woodi* and that caused by *Nosema apis*. Speaking for conditions in Europe he says that these two parasites cause losses which are out of all comparison to those caused by brood diseases. Doctor Zander, it will be recalled, was the first to describe the protozoan causing the Nosema disease. Owing to the discovery of *Acarapis woodi* in adjacent central European countries, Germany has followed the lead of the United States in prohibiting the importation of bees whether on combs or not. The importation of used hives is also prohibited.

Mr. L. M. Bertholf, who was engaged in a study of the development of the honeybee larvae at the Bee Culture Laboratory of the Bureau of Entomology, has resigned his temporary appointment to accept a position as Instructor in Biology at the Western Maryland University. He is also continuing graduate work at Johns Hopkins University.

All those interested in beekeeping who attend the coming meeting of the American Association of Science at Washington are invited to visit the Bee Culture Laboratory of the Bureau of Entomology on Tuesday, December 30. At this time the various phases of the work now being conducted at the Laboratory will be fully demonstrated.

This will include an exhibition of the instruments used in obtaining internal humidity and temperature records of the hive, an exhibition of over four hundred samples of honey from all sections of the country, the spectro-photometer or instrument used in an attempt to establish color grades for honey, the special photographic apparatus used in obtaining records of brood development, the various bacteriological methods used in determining diseases, specimens of *Acarapis woodi*, as well as other things of interest.

Alertness by the Mississippi State Plant Board in the forepart of the year prevented a possible outbreak of American foulbrood when a beekeeper from another State moved a truckload of bees into one of the best honey-producing counties of Mississippi without proper authority. His action came to the attention of the Board almost immediately, however, and resulted in destruction of the apiary.

R. B. Willson, extension worker in charge of beekeeping for New York State, has equipped an automobile for demonstrating the use of the Hutzelman alcohol-formalin method for treating combs infected with American foulbrood.

Several interesting beekeeping books have appeared recently. One of these, "Law of the Honeybee," published by The American Honey Producers' League, aims to give all court decisions affecting beekeepers' rights. Two beekeeping books have appeared from England, one entitled "Beekeeping for Beginners" by I. H. Jackson, and the other "Practical Beekeeping" by Arthur M. Sturges. Rev. Ivan F. Kitzberger of Czechoslovakia, editor of a journal devoted to scientific apiculture, has published a book, "Rostliny Medonosné," which gives in Czech a description of all the honey-plants found in the author's country, the Latin equivalents being given for all generic and specific names, and the German equivalents for all generic names.

Among recent state bulletins is that by Russell H. Kelty, entitled "Seasonal Management for Commercial Apiaries," published as Special Bulletin No. 135 of the Agricultural Experiment Station of Michigan Agricultural College. In August, Texas issued a reprint of its bulletin No. 255, "Beekeeping for Beginners."

As a publication of the Czechoslovak Ministry of Agriculture, Dr. Ot. Laxa has prepared a 116 page report on Czechoslovak honey. One section of the work is devoted to the results obtained from a chemical analysis of 166 different samples of honey from the author's country.

To settle a controversy as to which comb-honey granulates more quickly, that from the West or that from the East, beekeepers asked the Bee Culture Laboratory to take up a study of the rate of granulation in comb-honey from all sections of the country. To provide the Laboratory with samples of comb-honey for this purpose, beekeepers in several regions of the country have already sent specimens of their crop, and it is hoped that enough more will do likewise so as to have every portion of the country represented.

For some time Europeans have been more zealous in an attempt to better their bees by breeding than has been true of beekeepers in the United States. The cooperative methods employed for maintaining mating stations by beekeepers in Switzerland, Czechoslovakia, Germany, and Austria are known to all who read the beekeeping journals of Continental Europe. To most American beekeepers the term "mating station" is unknown. In recent months European workers in this field have been laying much emphasis on the fact that honey-gathering qualities should be considered of first importance, and that only secondary importance should be attached

to color, gentleness, non-swarming, and the like. Various strains of bees in the countries concerned are being developed by selective breeding under qualified supervision.

The following schedule of beekeeping meetings has been announced by the American Honey Producers' League: November 5–6, Portland, Oregon; November 6–8, Thermopolis, Wyoming; November 11–12, Denver, Colorado; November 14, Omaha, Nebraska; November 15, North Platte, Nebraska; November 18–19, South Dakota; November 20–21, Fargo, North Dakota; December 4–5, Madison, Wisconsin; December 9–10, Springfield Illinois; December 10–11, Lansing, Michigan; December 15–16, St. Paul, Minnesota; December 17–18, Des Moines, Iowa, and December 19–20, Montana. In addition to the above meetings, various state beekeeping associations will hold meetings as follows: January 8, Cambridge, Maryland; January 21–22, Pennsylvania; last week in January, Nashville, Tennessee; and February 5–6, Columbus, Ohio. Cornell University plans a short course beginning January 26, and Purdue University a short course during the middle of February.

Notes on Medical Entomology

The small species of predaceous fish, *Gambusia affinis*, imported recently from the States as a means of controlling mosquitoes, is reported by Mr. E. Hearle as thriving in the sulphur waters of Banff Springs.

The occurrence of a case of yellow fever in Houston, Texas, during October caused some temporary excitement; however, prompt diagnosis and immediate isolation of the case prevented any further spread of the disease even in the presence of a fairly abundant supply of yellow fever mosquitoes, *Aedes egypti*.

Miss Clara S. Ludlow of the Army Medical Museum, whose work on disease bearing mosquitoes has given her a distinguished place in the field of science, died in Washington, D. C., September 28, at the age of 70 years. Miss Ludlow discovered and described many new species of mosquitoes.

In connection with the Mosquito Investigations at Banff, Alta., a shipment of 600 fish of the species *Gambusia affinis* were sent to Mr. Eric Hearle on July 25. They arrived in excellent condition. They were forwarded through the kindness of Mr. L. G. Lenert, Sanitary Engineer, Sacramento Board of Health, Sacramento, California. This experiment of introducing fish which are predaceous upon mosquito larvae, will be watched with interest.

A few cases of dengue fever have occurred in Texas during the fall, but there has been no tendency for the malady to become widespread. The carrier of the disease, *Aedes egypti*, has been present in numbers rather above the average for this time of the year. It is probable that the large percentage of immunes is partially responsible for the comparative small number of cases this year.

During July, W. E. Dove of the United States Bureau of Entomology, began investigations of the human affliction known as "Larval Migrans," with headquarters at Jacksonville, Florida. This work was undertaken at the urgent request of Dr. J. Lee Kirby-Smith, one of the leading dermatologists of the South, who has been familiar with this malady in his practice for the past fourteen years. The entomological aspects of the work are being conducted by Mr. Dove under the general supervision of F. C. Bishopp. During the latter part of July a clinic was opened in Jack-

sonville in co-operation with the city and state boards of health. During the two weeks of this clinic one hundred and eighty-five patients infested with "Larval Migrans" presented themselves for treatment and gave case histories. This material is serving as a basis for a thorough epidemiological study of the malady. So far the causative organism has not been isolated and indications are that it is not the larva of an insect as was at first supposed. In addition to these studies, Mr. Dove is carrying on biological work in Florida with the Tabanidae.

The Connecticut Anti-Mosquito Association held an institute at the Agricultural Experiment Station, New Haven, Conn., on the afternoon of November 7. Among the speakers were Professor W. L. Slate, Jr., Director of the Station, Dr. W. E. Britton, State Entomologist, Mr. R. C. Botsford, Deputy in Charge of Mosquito Elimination, Dr. Stanley H. Osborn, Health Commissioner, Mr. George J. Bassett, President, New Haven Chamber of Commerce, and Messrs. H. H. Chapman, W. O. Filley and A. V. Parker, representing the State Park Commission. Mr. Malcolm R. Pitt, President, presided, and about 30 were present. A definite program for anti-mosquito work in the State was considered and will probably be placed before the next session of the legislature.

Pacific Slope Notes

Mr. Kenneth A. Salman has recently accepted a position as entomologist for the government of San Salvador. His work will be under the direction of Prof. Frederic W. Taylor who is Director General de Agricultura for that government.

According to *Science*, Mr. E. P. Van Duzee, curator of entomology, California Academy of Sciences, has returned from southern Arizona, where he and his assistant, Mr. J. O. Martin, spent six weeks collecting Hemiptera and other insects. He brought back about 15,000 specimens to enrich the Academy collections.

Mr. M. A. Yothers of the Bureau of Entomology, with headquarters at Yakima, Wash., made two official trips to the Puget Sound country during the summer to investigate the Narcissus bulb flies, *Merodon equestris* Fab., and *Eumerus strigatus* Fallen. It was found that these two flies are very abundant and injurious to Narcissus bulbs throughout the entire Sound region. Mr. Yothers also made a trip to South Idaho during August at the request of the Idaho State Department of Horticulture, to investigate the unprecedented injury to prunes by tree crickets, *Oecanthus* spp., which were eating the prunes to such an extent that they caused hundreds of thousands of dollars loss to the prune growers.

At the Pan-Pacific Food Conservation Conference held at Honolulu, H. I., July 31 to August 14, the following Entomologists were present: Doctors L. O. Howard and C. L. Marlatt, U. S. Bureau of Entomology, Washington, D. C.; Dr. T. D. A. Cockerell, University of Colorado, Boulder, Colo.; Dr. Royal N. Chapman University of Minnesota St. Paul, Minn.; Dr. Herbert Osborn, Ohio State University, Columbus, Ohio; Dr. Wm. B. Herms, University of California, Berkeley Calif.; Roy R. Reppert, Extension Entomologist, Texas.

The Sixth Annual Meeting of the Northwestern Association of Horticulturists, Entomologists, and Plant Pathologists, was held at Penticton, B. C., August 26–29, 1924. There was a varied program of general horticultural interest, and the entomological section of it included discussions of oil sprays, grasshoppers, wireworms,

strawberry weevils, and of methods of combating certain forest tree insects. The program was concluded with a luncheon served on the grounds of the Dominion Experimental Farm at Summerland, B. C., an inspection of the Farm, and a trip through the orchard sections of the Okanagan Valley. This organization is by no means as formal as the length of its name would indicate. Its chief purposes are to afford its members the opportunity of becoming better acquainted with each other, and of getting the other fellow's ideas about one's own particular problem. Over 75 members attended the meeting, including the following entomologists: Leroy Childs, Hood River, Ore.; N. L. Cutler, Vernon, B. C.; W. Downes, Victoria, B. C.; D. Dunavan, Toppenish, Wash.; Arthur Gibson, Ottawa; Eric Hearle, Banff, Alta.; Geo. R. Hopping, Vernon, B. C.; M. C. Lane, Toppenish, Wash.; A. L. Melander, Pullman, Wash.; E. J. Newcomer, Yakima, Wash.; Max M. Reeher, Forest Grove, Ore.; Max Ruhman, Vernon, B. C.; B. J. Thompson, Corvallis, Ore.; E. P. Venables, Vernon, B. C.; and P. N. Vroom, Vernon, B. C.

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Thirty-Seventh Annual Meeting of the American
Association of Economic Entomologists
Washington, D. C.
December 31, 1924 to January 3, 1925

THIRTY-SEVENTH ANNUAL MEETING OF THE AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS, WASHINGTON, D. C., DEC. 31, 1924 TO JAN. 3, 1925

The 37th annual meeting of the American Association of Economic Entomologists will be held at Washington, D. C., December 31, 1924 to January 3, 1925.

The meeting of the Sections of Apiculture and Horticultural Inspection will be held on Wednesday, December 31, prior to the opening session of the general association. The opening business session of the association will be held Thursday morning, January 1, at which time the address of the President will be delivered. Meetings will continue on Friday and Saturday.

Sectional Meetings

The meeting of the Section of Apiculture will be held at 9:30 a. m., Wednesday, December 31, in the Gymnasium, Central High School.

The Section of Horticultural Inspection will meet at 1:30 p. m., Wednesday, December 31, in the Gymnasium, Central High School.

Other Meetings

The annual meeting of the American Association for the Advancement of Science and many of its sections and affiliated societies will be held December 29, 1924 to January 3, 1925.

The Entomological Society of America will open its meeting on Monday, December 29, and continue its sessions through Wednesday, December 31. Dr. L. O. Howard will deliver the public address before this Society, December 31, at 8 p. m.

The Entomologists of Washington are giving the visiting Entomologists a smoker on the evening of December 31. This will take place after the delivery of the public address by Dr. L. O. Howard.

The Extension Entomologists will hold a meeting at the Hotel Harrington, January 1 at 8 p. m. Those interested in extension work should make an especial attempt to attend this meeting.

The Crop Protection Institute will hold its annual business meeting together with discussion of projects on hand, immediately after a

6 o'clock supper on Wednesday, December 31. The place of the meeting will be announced later.

Hotel Headquarters

Hotel headquarters for this Association will be at the Harrington, 11th and E Streets. Rates as follows:

Single room, without bath	$3.00
Double room, without bath	4.00
Single room, with bath	3.50
Double room, with bath	5.00 to 6.00

Railroad Rates

Reduced rates will be secured from some of the railroads. Members should obtain exact information prior to the time of the meeting from their local railroad agent or from Dr. Burton E. Livingston, Permanent Secretary, American Association for the Advancement of Science, Smithsonian Institution, Washington, D. C.

Dinner

The entomologists dinner will be held on Friday evening, January 2, 7 p. m., at Harvey's.

Membership

Applications for membership can be secured from the Secretary or from the Committee on Membership. These should be filled out, properly endorsed, and filed with the Membership Committee on or before December 31. Every application must be accompanied with a fee of $4.00 to cover dues and subscription to the Journal for the year following election.

Exhibits

It is planned to have exhibits consisting of appliances and apparatus used in connection with entomological work, also life history sets, distribution maps and specimens showing damage caused by some of the important economic insects. These exhibits will be displayed near the meeting room.

The Bee Culture Laboratory of the Bureau of Entomology will have open house on Tuesday, December 30, and an invitation is extended to members of the Association and others interested. The various prob-

lems will be explained and mimeographed directions for reaching the Laboratory from headquarters will be furnished at the time of the meeting.

Program

SECTION OF APICULTURE

R. W. HARNED, *Chairman* G. M. BENTLEY, *Secretary*

Wednesday Morning Session, December 31, 9:30
Gymnasium, Central High School

Address of the Chairman, R. W. Harned, Agricultural College, Miss.

READING OF PAPERS AND DISCUSSIONS

1. The Seventh International Apicultural Congress. (10 min.) E. F. Phillips, Ithaca, N. Y.

2. Notes on Bee Diseases in Connecticut. (10 min.) Philip Garman, New Haven, Conn.

3. Some Things Entomologists Might Easily do to Promote Honey Production. (15 min.) Kenneth Hawkins, Watertown, Wisc.

4. Physiological Factors Affecting the Development of the Brood Diseases of Bees. (10 min.) A. P. Sturtevant, Washington, D. C.

5. The Quantitative and Qualitative Effect of Weather Upon Colony Weight Changes. (10 min.) J. I. Hambleton, Washington, D. C.

6. Brood Rearing Studies. (10 min.) J. H. Merrill, Manhattan, Kans.

7. The Sense of Smell as a Factor Enabling the Bee to Locate Pastures. (5 min.) W. A. Price, LaFayette, Ind.

8. Federal Cooperation in Apiary Inspection Proposed. (10 min.) S. B. Fracker, Madison, Wisc.

9. Brood-rearing Determinations. W. J. Nolen, Washington, D.C.

10. Symposium: Inspection Methods in Different States.

Report of Committees.

Selection of Officers.

Adjournment.

Program

SECTION OF HORTICULTURAL INSPECTION

E. R. Sasscer, *Chairman* W. B. Wood, *Secretary*

Wednesday Afternoon Session, December 31, 1:30
Gymnasium, Central High School

Address by the Chairman, E. R. Sasscer, Washington, D. C.

Reading of Papers and Discussions

1. Recent Work of the Federal Horticultural Board. C. L. Marlatt, Washington, D. C.

2. The Camphor Scale Situation. (12 min.) (Lantern.) H. K. Plank, New Orleans, La.

3. Methods Employed in Enforcing the Gipsy Moth and Brown-tail Moth Quarantines. (15 min.) D. M. Rogers, Boston, Mass.

4. Port Inspection and a Few of the Problems which are Encountered. (15 min.) L. A. Strong, Washington, D. C.

5. Japanese Beetle Quarantine Operations. (15 min.) C. W. Stockwell, Riverton, N. J.

Reports of Committees.

Selection of Officers.

Adjournment.

Program

AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

Thursday Morning, January 1, 9:30; Gymnasium,
Central High School

Report of the Secretary.

Report of Subscription Agent, by C. W. Collins, Melrose Highlands, Mass.

Report of the Executive Committee, by President A. F. Burgess.

Report of the Representative to the National Research Council, by George A. Dean, Washington, D. C.

Report of the Committee on Policy, by E. P. Felt, Albany, N. Y.

Report of the Trustees of the Crop Protection Institute, by W. C. O'Kane, Durham, N. H.

Report of Scientific Trustee, Tropical Plant Research Foundation.

Report of the Representatives on the Council of the Union of American Biological Societies, by A. L. Quaintance, Washington, D. C.

Report of the Committee on Nomenclature, by Edith M. Patch, Orono, Maine.

Report of the Committee on Index to Economic Entomology, by E. P. Felt, Albany, N. Y.

Report of the Committee on United States National Museum, by W. E. Hinds, Baton Rouge, La.

Report of Representative Appointed to Attend the Association of Southern States Entomologists, by Herbert Osborn, Columbus, Ohio.

Report of Committee to Standardize methods of Estimating insect abundance and damage, by J. A. Hyslop, Washington, D. C.

Report of Committee Concerning the Purchase of the William Barnes Collection for the U. S. National Museum, by J. J. Davis, Lafayette, Ind.

Appointment of Committees.

Miscellaneous Business.

New Business.

Annual Address of the President, A. F. Burgess, Melrose Highlands, Mass.

1. "Our Association."

Discussion of the Presidential Address.

Program

Thursday Afternoon Session, January 1, 1925, 1:30
Gymnasium, Central High School

READING OF PAPERS

Insects Affecting Cereal, Forage and Field Crops

2. The Chinch Bug and the Weather. (10 min.) (Lantern.) J. A. Hyslop, Washington, D. C.

A correlation of the climatic factors and chinch bug outbreaks from 1870 to 1920.

3. The Hessian Fly Problem in Kansas. (10 min.) J. W. McColloch, Manhattan, Kansas.

4. The Relation of Hessian Fly Damage to Yield. (5 min.) (Lantern.) C. C. Hill, Carlisle, Pa., and H. D. Smith, Carlisle, Pa.

5. The Organized Co-operative Campaign Against Grasshoppers in Wisconsin. (5 min.) (Lantern.) A. A. Granovsky, Madison, Wisc.

6. The Arsenical Poisoning of Live Stock. (10 min.) Geo. I. Reeves, Salt Lake City, Utah.

Toleration of animals for arsenic, clinical diagnosis, post-mortem diagnosis; Dr. Gardner's experiments; relation to spraying for the alfalfa weevil.

7. *Phthorimaea operculella* in the Eastern States. (10 min.) (Lantern.) Herbert Spencer and W. O. Strong, Norfolk, Va.

A discussion of the recent outbreak of the insect, and its relation to potato and tobacco growing.

8. Economic Wireworms of the Pacific Northwest (Elateridae). (10 min.) M. C. Lane, Toppenish, Wash.

Paper will be a brief summary of Life History work and control of several Economic wireworms of Pacific Northwest.

9. The Status of the European Corn Borer in Ontario (1924). (8 min.) L. S. McLaine and H. G. Crawford, Ottawa, Canada.

A brief review of the European Corn Borer situation in Ontario, indicating the increase in intensity of infestation in certain districts and spread during 1924.

10. Status of the European Corn Borer in the United States in 1924. (10 min.) (Lantern.) D. J. Caffrey, Arlington, Mass.

General summary of spread and results of investigations on the control, habits, distribution and parasites of the corn borer. Includes European observations during 1924.

11. On Certain Behavior of the European Corn Borer. (5 min.) L. L. Huber, Wooster, Ohio.

Insects Affecting Truck Crops

12. A New and Effective Control for the Onion Maggot. (10 min.) (Lantern.) W. P. Flint and C. C. Compton, Urbana, Ill.

Results of experimental work in the control of the onion maggot extending over a period of six years conducted in the large onion growing sections in Cook County, Illinois.

13. Cull Onions as a Trap Crop for the Onion Maggot. (5 min.) J. E. Dudley, Jr., Madison, Wisc.

Results of experiments in the use of cull onions planted early in the spring to attract adults of the onion maggot, and yields.

14. The Pea Aphis (*Illinoia pisi*) with Special Reference to Alfalfa. (10 min.) R. C. Smith and E. W. Davis, Manhattan, Kansas.

An account of recent outbreaks in Kansas and a summary of field and laboratory observations on its habits and life history.

15. Natural Enemies of the Pea Aphid (*Illinoia pisi* Kalt.); their Abundance and Distribution in Wisconsin. (5 min.) Chas. L. Fluke, Jr., Madison, Wisc.

The pea aphid predators are many and varied. Studies this past year at Columbus, Wis. give some idea of the abundance of certain groups and the relative importance of others. Numerous species not heretofore mentioned are included in the list.

16. Climate as Related to Mexican Bean Beetle Distribution. (10 min.) (Lantern.) J. E. Graf, Washington, D. C.

17. Recent Developments of Mexican Bean Beetle Investigations. (10 min.) (Lantern.) Neale F. Howard, Birmingham, Ala.

Brief review of spread, biology and control of Mexican bean beetle.

18. Non-arsenicals for Chewing Insects. (10 min.) S. Marcovitch, Knoxville, Tenn.

19. Percentage of Curly Leaf Infection in Beet Leafhopper (*Eutettix tenella* Baker) and Winter Host Plants under Field Conditions. (5 min.) Henry H. Severin, Berkeley, Calif.

20. The Control of the Spinach Aphis, *Myzus persicae* Sulz., Infesting Cauliflower Seed Beds on Long Island, by Tobacco Dust Mixtures. (10 min.) (Lantern.) H. C. Huckett, Riverhead, Long Island, N. Y.

21. Celery Leaf Tyer in California. (10 min.) R. E. Campbell, Alhambra, Calif.

Insects Affecting Greenhouse Crops

22. Further Data on the use of Calcium Cyanide as a Greenhouse Fumigant. (5 min.) C. A. Weigel, Washington, D. C.

Observations on the behavior of calcium cyanide with reference to the length of exposure. Results are given of further tests with this material when used under commercial growing conditions in greenhouses.

23. Notes on the Life History of the Lesser Bulb Fly, *Eumerus strigatus* Fallen. (5 min.) (Miss) B. M. Broadbent, Washington, D. C.

Brief account of life history under cage conditions in greenhouse including recent data on feeding habits of larva and fly, on eggs and place of oviposition, and on duration of different stages.

24. *Eurytoma* (*Isosoma*) *orchidearum* Westwood, The Orchid or Cattleya Fly. (8 min.) (Lantern.) C. F. Doucette, Willow Grove, Pa.

Economic importance, and present methods of control.

Program

Friday Morning Session, January 2, 1925, 9:30
Gymnasium, Central High School

READING OF PAPERS

25. Observations on Biological Control Work in California. (10 min.) (Lantern.) Harry S. Smith, Riverside, Calif.

Data with reference to the commercial aspects of control of citrus pests by use of natural enemies.

26. The Dissemination of Insects by Air Currents. (10 min.) E. P. Felt, Albany, N. Y.

A summation of the evidence relative to insects being carried by air currents.

27. Stability in Scientific Names. (5 min.) R. W. Doane, Stanford University, Calif.

28. Entomologists Entering Commercial Fields. (5 min.) J. G. Sanders, Philadelphia, Pa.

A hopeful indication that the standards of commercial companies are improving with their realization that trained men are necessary to their success.

29. Foreign Travel and Entomologists Met while Searching for Enemies of the Gipsy Moth and the Brown-tail Moth. (10 min.) S. S. Crossman, Melrose Highlands, Mass.

A brief outline of the area covered and foreign entomologists visited during recent travels in Europe and northern Africa investigating Gipsy Moth and Brown-tail Moth infestations with a view to obtaining insect parasites and predators for introduction into the United States.

30. The Influence of Temperature and Humidity upon the Life Cycle of *Myzus houghtonensis* Troop. (5 min.) (Lantern.) D. M. DeLong and A. A. Mathewson, Columbus, Ohio.

A study of the life cycle of *Myzus houghtonensis* with special reference to the effect of temperature and humidity upon the variation in the number of days required for various season generations.

31. Extension Methods and Results in Kansas Entomology. (10 min.) E. G. Kelly, Manhattan, Kansas.

Presents outline of procedure in putting over effective methods of controlling the Hessian fly, chinch bug, potato bug and grasshoppers, giving value in dollars.

Insects Affecting Fruit

32. A Bait which Attracts the Oriental Fruit Moth (*Laspeyresia molesta* Busck.) (10 min.) (Lantern.) Alvah Peterson, New Brunswick, N. J.

A preliminary report on two years' experience with baits which attract the oriental fruit moth. Also some notes on the habits and life history of *Laspeyresia molesta* Busck.

33. Additional Notes on the Life History and Behavior of the Oriental Fruit Moth (*Laspeyresia molesta* Busck.) in Pennsylvania. (5 min.) T. L. Guyton, Harrisburg, Pa.

34. Orchard Control Work of 1924 Against the Oriental Peach Moth in South Jersey. (10 min.) (Lantern.) L. A. Stearns, New Brunswick, N. J.

This paper is a record of observations and a report of results of experimental work in cultivation, spraying and dusting conducted on the plots at the Seabrook Farm in South Jersey, which were visited by the members of the American Association of Economic Entomologists at their field meeting on Aug. 1, 1924.

35. *Laspeyresia molesta* Busck. as a Quince Pest. (5 min.) (Lantern.) E. N. Cory, College Park, Md.

Records of unusual losses, the overwintering habits and the treatment of containers.

36. Life History of the Pecan Nut Case-bearer (*Acrobasis caryivorella*). (10 min.) (Lantern.) S. W. Bilsing, College Station, Tex.

A brief survey of the life history of the pecan nut case-bearer extending over a period of 6 years.

37. A Small Contribution to Knowledge of Arsenical Requirements for Control of Codling Moth. (10 min.) T. J. Headlee, New Brunswick, N. J.

Under conditions of extreme codling moth abundance and the presence of two broods, the field control exerted by arsenicals varies within limits as the amount of arsenical used and as the continuity with which the coating is maintained.

38. The Efficiency of Dust and Spray Mixtures in Controlling the Rosy Aphis. (5 min.) P. J. Parrott and Hugh Glasgow, Geneva, N. Y.

Reports the results of a series of experiments with several oil emulsions and various dust and spray mixtures to determine their value in controlling the rosy aphis. The merits of delayed dormant, early and late pink, and calyx applications are also considered.

39. The Natural Enemies of the Citrus Aphid (*Aphis spiraecola* Patch) in Florida. (10 min.) F. R. Cole, Orlando, Fla.

Statement of importance of pest and control by insect enemies (of three orders), all predators.

40. The Citrus Aphid Outlook. (10 min.) (Lantern.) A. C. Baker, Washington, D. C.

In the spring of 1924 there occurred in Florida an epidemic of an aphid on citrus. Transfer tests have proved the species concerned to be *Aphis spiraecola* Patch. A correlation between the growth of the epidemic and climatic conditions has indicated that the epidemic may in great part be laid to these conditions.

41. Notes on Applied Entomology in Spain with Special Reference to the Mediterranean Fruit Fly (*Ceratitis capitata* Wied.). (10 min.) (Lantern.) M. D. Leonard, Ridgewood, N. J.

42. The Value of the Dry Substitutes for Liquid Lime Sulphur as a Control for San Jose Scale. (10 min.) (Lantern.) J. J. Culver, Vienna, Va.

Presents results of three years' work against San Jose scale.

43. San Jose Scale Control with Lubricating Oil Emulsion on Peach Trees in the South. (10 min.) C. H. Alden, Fort Valley, Ga.

Program

Friday Afternoon Session, January 2, 1925, 1:30
Gymnasium, Central High School

READING OF PAPERS

Insecticides

44. A Method of Computing the Effectiveness of an Insecticide. (10 min.) (Lantern.) W. S. Abbott, Vienna, Va.

A formula is proposed for obtaining a figure called "percent control" by means of which a series of results based on different checks may be compared.

45. An Investigation of Sulfur as an Insecticide. (7 min.) Albert Hartzell, Yonkers, N. Y. and F. H. Lathrop.

A preliminary study of the toxicity of sulfur with special reference to the solvent action of lime sulfur on San Jose scale.

46. Fish Oil—An Efficient Adhesive in Arsenate of Lead Sprays, and Results with Other Substances Used. (10 min.) (Lantern.) C. E. Hood, Melrose Highlands, Mass.

A brief discussion of the different substances used, and the comparison of each as to adhesive qualities. These experiments were conducted at Melrose Highlands and Saugus, Mass., and Somerville, N. J.

47. The Dipyridyls as Contact Insecticides. (10 min.) (Lantern.) C. H. Richardson, Washington, D. C.

48. Electric Charges on Insecticide Particles. (10 min.) William Moore, New York, N. Y.

Difference between static electric charges imparted by friction and charges due to absorbed ions.

49. Miscible Oils and Oil Emulsions. (10 min.) J. G. Sanders, Philadelphia, Pa.

Discussion of emulsions and oils for emulsions and some of the pitfalls encountered in making and using oil emulsions.

50. Quantitative Studies on the Toxicology of Arsenical Insecticides. (10 min.) F. L. Campbell, Forest Hills, Boston, Mass.

By feeding individual caterpillars known quantities of arsenical solutions, quantitative relationships between dose and survival time were studied.

51. A Preliminary Report on the Preparation of Insecticide Emulsions with a Colloidal Clay. (5 min.) L. L. English, Ames, Iowa.

52. Observations on Insects Developing Immunity to Insecticides. (10 min.) R. S. Woglum, Pasadena, Calif.

Certain scale insects of citrus trees in California require heavier dosages of HCN for control than formerly. The areas of resistant scale are being extended.

53. The Use of Fatty Acids as a Contact Insecticide. (10 min.) E. H. Siegler and C. H. Popenoe, Washington, D. C.

An investigation of the aliphatic fatty acids has shown that certain members of the saturated series possess promising insecticidal properties as contact sprays. The studies have indicated that the toxicity of soaps when used as contact sprays is due to the release of the acid components through hydrolytic dissociation.

54. "Gassing Ants"—Experiments in Killing the "Hormiguilla," *Myrmelachista ambigua vamulorum* Wheeler, of Porto Rican Coffee Groves with Cyanide. (5 min.) George N. Wolcott, Barneveld, N. Y.

55. The Distribution of an Insecticide Made Visible. (10 min.) (Lantern.) A. C. Morgan and R. G. Newborne, Clarksville, Tenn.

A mixture of phenolphthalein and arsenate of lead was dusted on tobacco. A print of the leaves was taken on filter paper impregnated with an aqueous solution of sodium hydrate. The prints were immediately dried in an oven to prevent spreading of the indicator and were then paraffined for preservation.

56. A Coloremetric Method for Showing the Distribution and Amount of Lead Arsenate upon Sprayed and Dusted Surfaces. (10 min.) (Lantern.) C. C. Hamilton and C. M. Smith, College Park, Md.

Insects Affecting Stored Products

57. Present Status of the Use of Electricity in Control of Stored Product Insects. (10 min.) (Lantern.) E. A. Back and R. T. Cotton, Washington, D. C.

Brief status concerning use of electricity.

58. Control of the Saw-toothed Grain Beetle in Raisins: A Preliminary Report. (10 min.) (Lantern.) J. C. Hamlin and Curtis Benton, Fresno, Calif.

Summarizes experiments in connection with (1) reducing existing severe infestations and (2) preventing infestation of incoming raisins in the plants.

59. A Newly Recommended Fumigant; Ethyl Acetate in Combination with Carbon Tetrachloride. (10 min.) E. A. Back and R. T. Cotton, Washington, D. C.

The effectiveness of Ethyl Acetate—Carbon Tetrachloride mixture as a fumigant for stored product insects under certain conditions.

60. The Causes of Outbreaks of the Angoumois Grain Moth. (10 min.) Perez Simmons and G. W. Ellington, Silver Spring, Md.

The correlations between Angoumois grain moth abundance and the thermal environment in a selected area (the region around Philadelphia) during the past 28 years indicate the probability that the principal factor influencing the occurrence of moth outbreaks there is the temperature from June to October. Time of harvest and winter temperatures also appear to be of importance.

61. Relative Abundance and Control of Grain Moth (*Sitotroga cerealella*) in Pennsylvania in 1924. (3 min.) (Lantern.) H. B. Kirk, Harrisburg, Pa.

Field studies showing possible means of control by farm practices.

62. A Practical Control of the Common Bean Weevil, *Bruchus obtectus* Say. (10 min.) A. O. Larson and C. K. Fisher, Alhambra, Calif.

A progress report dealing with the field control work which has been carried on in California.

Program

Saturday Morning Session, January 3, 1925, 9:30
Gymnasium, Central High School

READING OF PAPERS

Insects Affecting Man and Animals

63. Controlling Bedbugs in Steam-heated Rooms. (10 min.) (Lantern.) R. W. Harned and H. W. Allen, A. &.M. College, Miss.

64. Repellents and Larvicides for the Screw worm and other Flies—Report of Progress. (10 min.) F. C. Bishopp, R. C. Roark, D. C. Parman and E. W. Laake, Dallas, Texas.

Treats of recent work on the chemotropic responses of the screw worm and other flies and discusses investigations of the more promising repellents against them.

65. The Occurrence of Cuterebrid Larvae in Dogs and Cats, and the Possible Modes of Infestation. (8 min.) M. C. Hall, Washington, D. C.

This paper summarizes the records to date, adds a number of new ones, discusses the possible modes of infection, and points out the economic interest of the subject, the evidence showing that these cases are fairly common.

66. Intestinal Myasis and The Common House-Fly (*Musca domestica* L.). (2 min.) T. H. Frison, Urbana, Ill.

67. Tests of Internal Medication for External Parasites of Fowls. (10 min.) D. C. Parman, Uvalde, Texas.

Insects Affecting Forest and Shade Trees

68. Two Dangerous Defoliators of Jack Pine. (10 min.) (Lantern.) S. A. Graham, St. Paul, Minn.

This paper describes an outbreak of the jack pine sawfly and the jack pine tip moth now in progress in the Lake States.

69. Some Results of Defoliation of Oak Trees. (10 min.) (Lantern.) C. W. Minott and I. T. Guild, Melrose Highlands, Mass.

70. Methods of Control for two Shade-tree Pests. (5 min.) Glenn W. Herrick, Ithaca, N. Y.

The maple bladder-gall (*Phyllocoptes quadripes*) is readily susceptible to applications of lime-sulphur while the spruce-gall aphid (*Chermes abietis*) is readily susceptible to applications of lime-sulphur and of miscible oils. Experimental work of the past 3 years demonstrate the ease with which these pests may be controlled. A full discussion of the biology and control of the latter pest is in preparation.

71. A Preliminary Report on the Use of Calcium Cyanide for the Mound Building Ant, *Formica exsectoides*. (10 min.) (Lantern.) J. A. Manter, Storrs, Conn.

A report of the results obtained by using calcium cyanide for control of the mound building ant in forest plantations.

72. Barkbeetle Epidemics and Rainfall Deficiency. (10 min.) F. C. Craighead, Washington, D. C.

Japanese Beetle

73. The Status of the Japanese Beetle in 1924. (5 min.) Loren B. Smith, Riverton, N. J.

A resume of results secured in control and prevention of spread.

74. A Preliminary Report on the Parasites of *Popillia japonica*. (10 min.) (Lantern.) J. L. King and H. C. Hallock, Riverton, N. J.

This paper deals with the establishment and rearing of parasites of *Popillia japonica*.

75. Three Years Observation on the Biology of *Popillia japonica*. (10 min.) (Lantern.) C. A. Thomas, Riverton, N. J.

A comparison of the important phases in the life-cycle of Popillia for the years 1922–1924 inclusive.

76. The Fumigation of Balled Nursery Stock. (10 min.)(Lantern.) B. R. Leach and W. E. Fleming, Riverton, N. J.

The soil-ball is fumigated with carbon disulphide vapor, the foliage being submerged in water during the operation by means of a special apparatus.

77. Coated Arsenate of Lead and the Physical Chemistry of the Coating Process. (10 min.) E. R. VanLeeuwen and Dr. P. A. van der-Meulen, Riverton, N. J.

This paper deals with the coating of lead arsenate with a metallic soap and its use against the Japanese beetle. When lead oleate is precipitated under proper conditions it forms an intimate mixture consisting of globules of lead oleate with uncoated particles of arsenate of lead. After drying the lead oleate spreads upon the surface of the arsenate of lead powder and upon the leaf and produces a coated material which adheres very firmly to the leaf surface.

78. Geraniol, a Primary Attractent of the Japanese Beetle. (10 min.) (Lantern.) Loren B. Smith and E. A. Richmond, Riverton, N. J.

The results of three years' study of essential oils and their constituents with regard to their effect upon the activities of the Japanese Beetle.

79. Chemicals Found Attractive to Insects. (10 min.) N. E. McIndoo, Washington, D. C.

FINAL BUSINESS

Report of Committee on Resolutions.
Report of Committee on Membership.
Reports of other committees.
Nomination of JOURNAL officers by advisory committee.
Report of Committee on Nominations.
Election of Officers.
Miscellaneous business.
Fixing the time and place of next meeting.
Final adjournment.

A. F. BURGESS, *President*,
Melrose Highlands, Mass.

C. W. COLLINS, *Secretary*,
Melrose Highlands, Mass.

JOURNAL OF ECONOMIC ENTOMOLGY

August 15, 1924

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Official Organ of American Association of Economic Entomologists

A bimonthly journal published February to December, on the 15th of the month, devoted to the interests of Economic Entomology and publishing the official notices and proceedings of the American Association of Economic Entomologists. Address business communications to the Journal of Economic Entomology, Geneva, N.Y.

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